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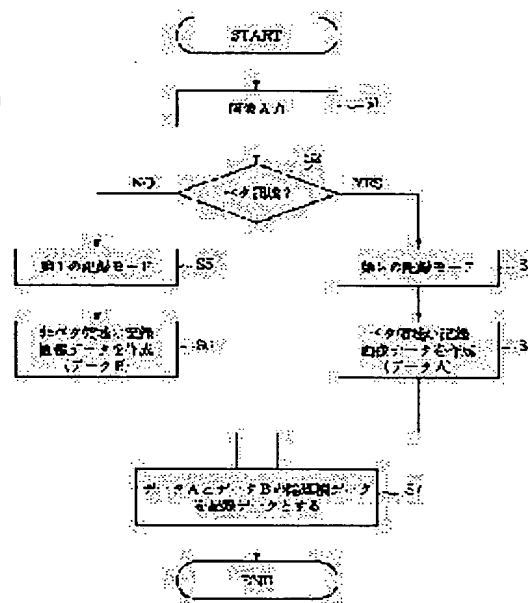
JP

(54) INK-JET RECORDING METHOD, INK-JET RECORDING DEVICE, COMPUTER READABLE MEMORY MEDIUM, AND PROGRAM

(57)Abstract:

PROBLEM TO BE SOLVED: To provide an ink-jet recording device and a recording method capable of achieving both high image quality and high speed, using a recording head with nozzles having a small nozzle diameter arranged in a high density.

SOLUTION: Whether a predetermined area of an image to be recorded is recorded only with a recording ink, or the predetermined area is recorded with both recording ink and clear ink is determined according to image data of the predetermined area. A recording operation is executed based on the determination result using a recording head having a nozzle row with ink ejection nozzles and clear ink ejection nozzles arranged alternately.



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CLAIMS

[Claim(s)]

[Claim 1] The recording head which has the nozzle train by which at least one liquid regurgitation nozzle for carrying out the regurgitation of the liquid which does not contain substantially at least one ink regurgitation nozzle and color material for carrying out the regurgitation of the ink containing color material adjoined in the predetermined direction by turns, and has been arranged is used. It is the ink jet record approach which records an image by carrying out the regurgitation of said ink and said liquid to said recorded media, making said recording head and recorded media scan relatively. The decision process which determines whether to record some [at least] fields in the image which should be recorded only in said ink, or record said field on the both sides of said ink and said liquid, When it has the record process which records said field based on the decision result by said decision process and records said field on the both sides of said ink and said liquid, at said record process Each of the liquid breathed out from the liquid regurgitation nozzle which adjoins the ink breathed out from a predetermined ink regurgitation nozzle and said predetermined ink regurgitation nozzle reaches the location where it differs on said recorded media. The ink jet record approach characterized by said ink which reached the target and said liquid which reached the target contacting on said recorded media.

[Claim 2] The liquid breathed out from the liquid regurgitation nozzle which adjoins the ink breathed out from said predetermined ink regurgitation nozzle and said predetermined ink regurgitation nozzle is the ink jet record approach according to claim 1 characterized by being breathed out during the same scan.

[Claim 3] The liquid breathed out from the liquid regurgitation nozzle which adjoins the ink breathed out from said predetermined ink regurgitation nozzle and said predetermined ink regurgitation nozzle is the ink jet record approach according to claim 1 or 2 characterized by being liquefied and mixing on said recorded media.

[Claim 4] The ink jet record approach according to claim 1 to 3 characterized by determining to record only in said ink at said decision process when said field is a non-solid field, and determining to record on the both sides of said ink and said liquid when said field is a solid field.

[Claim 5] The ink jet record approach according to claim 1 to 3 characterized by determining to record only in said ink at said decision process when said field is an alphabetic character field, and determining to record on the both sides of said ink and said liquid when said field is an ungrammatical sentence character field.

[Claim 6] The ink jet record approach according to claim 1 to 3 characterized by determining whether to record said field only in said ink at said decision process according to the class and recording rate mode of an image which should be recorded, or record said field on the both sides of said ink and said liquid.

[Claim 7] The ink jet record approach according to claim 6 characterized by the class of said image which should be recorded being the gap chosen from the group which consists of an image with which the document image, the ungrammatical sentence paintings-and-calligraphic-works image, the document image, and the ungrammatical sentence paintings-and-calligraphic-works image were intermingled, or one.

[Claim 8] The ink jet record approach according to claim 6 characterized by said recording rate

mode being high definition mode which records one line of the fast mode which records one line of recorded media by one horizontal scanning of a recording head, or recorded media by horizontal scanning of the multiple times of a recording head.

[Claim 9] The class and said recording rate mode of said image which should be recorded are the ink jet record approach according to claim 6 to 8 characterized by a user choosing.

[Claim 10] The ink jet record approach according to claim 1 to 3 characterized by determining to record the edge section of the image which should be recorded only in said ink at said decision process, and determining to record the non-edge section of said image on the both sides of said ink and said liquid.

[Claim 11] The ink jet record approach according to claim 10 characterized by having further the process which separates the edge section and the non-edge section of said image.

[Claim 12] The dot of said non-edge section which faces recording said non-edge section and adjoins said edge section by the dot of the both sides of the ink dot in said ink and a liquid dot with said liquid is the ink jet record approach according to claim 10 or 11 characterized by what is not recorded.

[Claim 13] The dot of said non-edge section which faces recording said non-edge section and adjoins said edge section by the dot of the both sides of the ink dot in said ink and a liquid dot with said liquid is the ink jet record approach according to claim 10 or 11 characterized by what is thinned out and recorded.

[Claim 14] The ink jet record approach according to claim 10 to 13 characterized by said image being at least one sort chosen from the alphabetic character, the line drawing, and the group that consists of a table.

[Claim 15] It has the process which separates the process which extracts the alphabetic character field in said image which should be recorded, and said edge section and non-edge section of the extracted alphabetic character field. At said decision process Determine to record said edge section only in said ink, and it determines to record said non-edge section on the both sides of said ink and said liquid. The ink jet record approach according to claim 1 characterized by determining to record ungrammatical sentence character fields other than said extracted alphabetic character field on the both sides of said ink and said liquid.

[Claim 16] Said recording head is the ink jet record approach according to claim 1 to 15 characterized by providing a heat energy generating means to make ink generate air bubbles by giving heat, and to make ink breathe out based on generating of said air bubbles.

[Claim 17] The ink jet record approach according to claim 1 to 16 characterized by the liquid which does not contain said color material substantially being clear ink which removed color material from said ink.

[Claim 18] The recording head which has the nozzle train by which at least one liquid regurgitation nozzle for carrying out the regurgitation of the liquid which does not contain substantially at least one ink regurgitation nozzle and color material for carrying out the regurgitation of the ink containing color material adjoined in the predetermined direction by turns, and has been arranged is used. It is the ink jet recording device which records an image by carrying out the regurgitation of said ink and said liquid to said recorded media, making said recording head and recorded media scan relatively. A decision means to determine whether to record some [at least] fields in the image which should be recorded only in said ink, or record said field on the both sides of said ink and said liquid, It has the record control means which controls said recording head so that the record based on the decision result by said decision means is made. When recording said field on the both sides of said ink and said liquid, each of the liquid breathed out from the liquid regurgitation nozzle which adjoins the ink breathed out from a predetermined ink regurgitation nozzle and said predetermined ink regurgitation nozzle reaches the location where it differs on said recorded media. The ink jet recording device characterized by said ink which reached the target and said liquid which reached the target contacting on said recorded media.

[Claim 19] The liquid breathed out from the liquid regurgitation nozzle which adjoins the ink breathed out from said predetermined ink regurgitation nozzle and said predetermined ink regurgitation nozzle is an ink jet recording device according to claim 18 characterized by being

breathed out during the same scan.

[Claim 20] The liquid breathed out from the liquid regurgitation nozzle which adjoins the ink breathed out from said predetermined ink regurgitation nozzle and said predetermined ink regurgitation nozzle is an ink jet recording device according to claim 18 or 19 characterized by being liquefied and mixing on said recorded media.

[Claim 21] Said decision means is an ink jet recording device according to claim 18 to 20 characterized by determining to record only in said ink when said field is a non-solid field, and determining to record on the both sides of said ink and said liquid when said field is a solid field.

[Claim 22] Said decision means is an ink jet recording device according to claim 18 to 20 characterized by determining to record only in said ink when said field is an alphabetic character field, and determining to record on the both sides of said ink and said liquid when said field is an ungrammatical sentence character field.

[Claim 23] Said decision means is an ink jet recording device given in either of claim 18 ** 20 characterized by determining whether to record said field only in said ink, or record said field on the both sides of said ink and said liquid according to the class and recording rate mode of an image which should be recorded.

[Claim 24] The ink jet recording device according to claim 23 characterized by the class of said image which should be recorded being the gap chosen from the group which consists of an image with which the document image, the ungrammatical sentence paintings-and-calligraphic-works image, the document image, and the ungrammatical sentence paintings-and-calligraphic-works image were intermingled, or one.

[Claim 25] The ink jet recording device according to claim 23 characterized by said recording rate mode being high definition mode which records one line of the fast mode which records one line of recorded media by one horizontal scanning of a recording head, or recorded media by horizontal scanning of the multiple times of a recording head.

[Claim 26] The class and said recording rate mode of said image which should be recorded are an ink jet recording device according to claim 23 to 25 characterized by a user choosing.

[Claim 27] Said decision means is an ink jet recording device according to claim 18 to 20 characterized by determining to record the edge section of the image which should be recorded only in said ink, and determining to record the non-edge section of said image on the both sides of said ink and said liquid.

[Claim 28] The ink jet recording device according to claim 27 characterized by having further a means to separate the edge section and the non-edge section of said image.

[Claim 29] The dot of said non-edge section which faces recording said non-edge section and adjoins said edge section by the dot of the both sides of the ink dot in said ink and a liquid dot with said liquid is an ink jet recording device according to claim 27 or 28 characterized by what is not recorded.

[Claim 30] The dot of said non-edge section which faces recording said non-edge section and adjoins said edge section by the dot of the both sides of the ink dot in said ink and a liquid dot with said liquid is an ink jet recording device according to claim 27 or 28 characterized by what is thinned out and recorded.

[Claim 31] The ink jet recording device according to claim 27 to 30 characterized by said image being at least one sort chosen from the alphabetic character, the line drawing, and the group that consists of a table.

[Claim 32] It has further with a separation means to separate an extract means to extract the alphabetic character field in said image which should be recorded, and said edge section and non-edge section of the extracted alphabetic character field. Said decision means Determine to record said edge section only in said ink, and it determines to record said non-edge section on the both sides of said ink and said liquid. The ink jet recording device according to claim 18 characterized by determining to record ungrammatical sentence character fields other than said extracted alphabetic character field on the both sides of said ink and said liquid.

[Claim 33] Said recording head is an ink jet recording device according to claim 18 to 32 characterized by providing a heat energy generating means to make ink generate air bubbles by giving heat, and to make ink breathe out based on generating of said air bubbles.

[Claim 34] The ink jet recording device according to claim 18 to 33 characterized by the liquid which does not contain said color material substantially being clear ink which removed color material from said ink.

[Claim 35] The recording head which has the nozzle train by which at least one liquid regurgitation nozzle for carrying out the regurgitation of the liquid which does not contain substantially at least one ink regurgitation nozzle and color material for carrying out the regurgitation of the ink containing color material adjoined in the predetermined direction by turns, and has been arranged is used. It is the computer-readable storage with which the program which performs record control processing of the ink jet recording device which records an image by carrying out the regurgitation of said ink and said liquid to said recorded media was stored, making said recording head and recorded media scan relatively. Said program The decision process which determines whether to record some [at least] fields in the image which should be recorded only in said ink, or record said field on the both sides of said ink and said liquid, The generation process which generates record data based on the decision result by said decision process is included. When recording said field on the both sides of said ink and said liquid is determined, Each of the liquid breathed out from the liquid regurgitation nozzle which adjoins the ink breathed out from a predetermined ink regurgitation nozzle and said predetermined ink regurgitation nozzle reaches the location where it differs on said recorded media. The computer-readable storage characterized by generating said record data in said generation process so that said ink which reached the target and said liquid which reached the target may contact on said recorded media.

[Claim 36] The computer-readable storage according to claim 35 characterized by determining to record only in said ink at said decision process when said field is a non-solid field, and determining to record on the both sides of said ink and said liquid when said field is a solid field.

[Claim 37] The computer-readable storage according to claim 35 characterized by determining to record only in said ink at said decision process when said field is an alphabetic character field, and determining to record on the both sides of said ink and said liquid when said field is an ungrammatical sentence character field.

[Claim 38] The computer-readable storage according to claim 35 characterized by determining whether to record said field only in said ink at said decision process according to the class and recording rate mode of an image which should be recorded, or record said field on the both sides of said ink and said liquid.

[Claim 39] The computer-readable storage according to claim 38 characterized by the class of said image which should be recorded being the gap chosen from the group which consists of an image with which the document image, the ungrammatical sentence paintings-and-calligraphic-works image, the document image, and the ungrammatical sentence paintings-and-calligraphic-works image were intermingled, or one.

[Claim 40] The computer-readable storage according to claim 38 characterized by said recording rate mode being high definition mode which records one line of the fast mode which records one line of recorded media by one horizontal scanning of a recording head, or recorded media by horizontal scanning of the multiple times of a recording head.

[Claim 41] The computer-readable storage according to claim 35 characterized by determining to record the edge section of the image which should be recorded only in said ink at said decision process, and determining to record the non-edge section of said image on the both sides of said ink and said liquid.

[Claim 42] The computer-readable storage according to claim 41 characterized by including the process which separates the edge section and the non-edge section of said image.

[Claim 43] The computer-readable storage according to claim 41 or 42 characterized by generating said record data so that the dot of said non-edge section which adjoins said edge section may not be recorded, when recording said non-edge section by the dot of the both sides of the ink dot in said ink and a liquid dot with said liquid is determined.

[Claim 44] The computer-readable storage according to claim 41 or 42 characterized by generating said record data so that the dot of said non-edge section which adjoins said edge section may be thinned out and recorded, when recording said non-edge section by the dot of

the both sides of the ink dot in said ink and a liquid dot with said liquid is determined.

[Claim 45] The computer-readable storage according to claim 41 to 44 characterized by said image being at least one sort chosen from the alphabetic character, the line drawing, and the group that consists of a table.

[Claim 46] The process which separates the process which extracts the alphabetic character field in said image which should be recorded, and said edge section and non-edge section of the extracted alphabetic character field is included. At said decision process Determine to record said edge section only in said ink, and it determines to record said non-edge section on the both sides of said ink and said liquid. The computer-readable storage according to claim 35 characterized by determining to record ungrammatical sentence character fields other than said extracted alphabetic character field on the both sides of said ink and said liquid.

[Claim 47] The recording head which has the nozzle train by which at least one liquid regurgitation nozzle for carrying out the regurgitation of the liquid which does not contain substantially at least one ink regurgitation nozzle and color material for carrying out the regurgitation of the ink containing color material adjoined in the predetermined direction by turns, and has been arranged is used. It is a program for controlling the ink jet recording device which records an image by carrying out the regurgitation of said ink and said liquid to said recorded media, making said recording head and recorded media scan relatively. The decision process which determines whether to record some [at least] fields in the image which should be recorded only in said ink, or record said field on the both sides of said ink and said liquid, The generation process which generates record data based on the decision result by said decision process is included. When recording said field on the both sides of said ink and said liquid is determined, Each of the liquid breathed out from the liquid regurgitation nozzle which adjoins the ink breathed out from a predetermined ink regurgitation nozzle and said predetermined ink regurgitation nozzle reaches the location where it differs on said recorded media. The program characterized by generating said record data in said generation process in said generation process so that said ink which reached the target and said liquid which reached the target may contact on said recorded media.

[Claim 48] The program according to claim 47 characterized by determining to record only in said ink at said decision process when said field is a non-solid field, and determining to record on the both sides of said ink and said liquid when said field is a solid field.

[Claim 49] The program according to claim 47 characterized by determining to record only in said ink at said decision process when said field is an alphabetic character field, and determining to record on the both sides of said ink and said liquid when said field is an ungrammatical sentence character field.

[Claim 50] The program according to claim 47 characterized by determining whether to record said field only in said ink at said decision process according to the class and recording rate mode of an image which should be recorded, or record said field on the both sides of said ink and said liquid.

[Claim 51] The program according to claim 50 characterized by the class of said image which should be recorded being the gap chosen from the group which consists of an image with which the document image, the ungrammatical sentence paintings-and-calligraphic-works image, the document image, and the ungrammatical sentence paintings-and-calligraphic-works image were intermingled, or one.

[Claim 52] The program according to claim 50 characterized by said recording rate mode being high definition mode which records one line of the fast mode which records one line of recorded media by one horizontal scanning of a recording head, or recorded media by horizontal scanning of the multiple times of a recording head.

[Claim 53] The program according to claim 47 characterized by determining to record the edge section of the image which should be recorded only in said ink at said decision process, and determining to record the non-edge section of said image on the both sides of said ink and said liquid.

[Claim 54] The program according to claim 53 characterized by including the process which separates the edge section and the non-edge section of said image.

[Claim 55] The program according to claim 53 or 54 characterized by generating said record data so that the dot of said non-edge section which adjoins said edge section may not be recorded, when recording said non-edge section by the dot of the both sides of the ink dot in said ink and a liquid dot with said liquid is determined.

[Claim 56] The program according to claim 53 or 54 characterized by generating said record data so that the dot of said non-edge section which adjoins said edge section may be thinned out and recorded, when recording said non-edge section by the dot of the both sides of the ink dot in said ink and a liquid dot with said liquid is determined.

[Claim 57] The program according to claim 53 to 56 characterized by said image being at least one sort chosen from the alphabetic character, the line drawing, and the group that consists of a table.

[Claim 58] The process which separates the process which extracts the alphabetic character field in said image which should be recorded, and said edge section and non-edge section of the extracted alphabetic character field is included. At said decision process Determine to record said edge section only in said ink, and it determines to record said non-edge section on the both sides of said ink and said liquid. The program according to claim 47 characterized by determining to record ungrammatical sentence character fields other than said extracted alphabetic character field on the both sides of said ink and said liquid.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the ink jet recording apparatus and the ink jet record approach of recording an image on recorded media using the ink containing color material, and the liquid which does not contain color material substantially.

[0002]

[Description of the Prior Art] Information management systems, such as a reproducing unit, and a word processor, a computer, and the ink jet recording device which records a digital image with an ink jet method further with the spread of communication equipment as one of the output units for the image formation (record) of those devices have spread quickly. In such a recording device, it considers as the recording head which comes to carry out the accumulation array of two or more ink regurgitation nozzles for improvement in a recording rate, and many things simultaneously equipped with two or more above-mentioned recording heads are seen as -izing corresponding to a color progresses in recent years further using what accumulated two or more ink deliveries and liquid routes.

[0003] An ink jet recording method makes recorded media, such as paper, reach the target by making into a flight-drop the ink which is recording ink, performs dot record, and since it is a non-contact method, it is the low noise. Moreover, by the densification of an ink regurgitation nozzle, high-resolution-izing and record[high-speed]-izing are possible, exceptional processing of a phenomenon, fixation, etc. is not further required to recorded media, such as a regular paper, but since it is possible to obtain a high-definition image by the low price, in recent years, the application is spreading widely. The colorization is easy for especially the ink jet recording device of a mold on demand, and, moreover, promising ** is carried out about future need from the miniaturization of equipment itself and simplification being possible. Moreover, along with the spread of the above colorization, high-definition-izing and improvement in the speed are demanded increasingly.

[0004] Thus, in the actual condition that high definition-izing is demanded, the various approaches about high-definition-izing are proposed. As the one approach of high-definition-izing, there is the approach of forming regurgitation ink into a small drop. For the formation of a small drop, it is most effective to make the diameter of a nozzle small, and high definition-izing is in drawing in arranging the ink regurgitation nozzle which made the diameter of a nozzle small in this way to high density. The reason small drop-ization of regurgitation ink leads to high definition-ization is that it can make [many] the number of gradation which can be expressed without a record dot's stopping being able to be conspicuous easily, and enlarging matrix size of 1 pixel if a small drop is formed. That is, small drop-ization of regurgitation ink makes it possible to make the number of gradation increase without reducing resolution. In addition, as a nozzle is arranged to high density, output resolution becomes higher, but since there is constraint on a manufacture process, there is a limitation also in this densification. Moreover, the same is said of the formation of a small drop, and 20-40 micrometers of the diameter of the discharge quantity record-dot on 1-several pico liter (several nanograms) and recorded media are a limitation in the constraint on a manufacture process to the actual condition.

[0005] Moreover, there is an approach using the shade ink of an affiliated color in which ink concentration differs as an option of high-definition-izing. By this approach, by recording the highlights section (low concentration section) in light ink, it is not conspicuous and the granular feeling by the record dot is carried out. Moreover, according to gradation, the ink of a shade is used properly, and it makes it possible to express more gradation. Thus, high definition-ization can be attained by using the ink of a shade. In addition, it is indicated by JP 59-115853A that the concentration of a record dot is thinned with recording transparency ink on a record dot in piles as an option which reduces the granular feeling in the highlights section of an image, and it can be made to do a light expression in the whole. According to JP 59-115853A, the number of gradation which can be expressed is not necessarily made to increase, but since the granular feeling in the highlights section of an image is reduced, it has led to high definition-ization after all.

[0006] Moreover, there is an approach to which the number of gradation which can be expressed by controlling the size of a record dot by pulse modulation as an option of high-definition-izing is made to increase. This is the approach of displaying gradation by changing the diameter of a dot by changing the dot record area per unit area, and changing the concentration on appearance.

[0007] Moreover, there is also an approach aiming at raising the grace of an alphabetic character (gradation level is not fixed) on high definition among the approaches of high-definition-izing. As an approach about improvement in such alphabetic character grace, there is edge enhancement which emphasizes the edge part of the alphabetic character section. For example, it calculates with the data which differentiated the secondary picture signal to JP 1-212176A, and carried out smoothing of the signal of a subject-copy image to it, and emphasizing an edge part is indicated. Moreover, it is indicated that JP 8-72236A makes [more] ink discharge quantity of an edge part than a non-edge part, and makes concentration of an edge part high at a number official report. An alphabetic character with a clear profile can be formed by performing such edge enhancement.

[0008]

[Problem(s) to be Solved by the Invention] Although various approaches are proposed in order to realize high definition-ization as mentioned above, there are the following various technical problems in these.

[0009] ** If regurgitation ink is formed into a small drop, although resolution becomes high, the area covered with each ink dot will become small. Then, since many number of the ink dots taken to cover the fixed area of recorded media is needed, lowering of a recording rate will be caused. That is, although small drop-ization of regurgitation ink contributes to high definition-ization, it is contrary to improvement in the speed.

[0010] ** If the ink regurgitation nozzle which made the diameter of a nozzle small is arranged to high density, as mentioned above, it is possible to make the number of gradation increase without reducing resolution, but even if it makes a nozzle consistency high recklessly, high definition-ization cannot necessarily be attained. It is because the contiguity ink dots on recorded media lap too much beyond the need and an ink dot may spread, if densification of the nozzle configuration is carried out too much. And such a blot degrades the grace of an image. Moreover, although there is a phenomenon in which ink should be caused, by the ink jet method, the more it carries out densification of the nozzle and makes it high resolution-ization more, the more there is evil in which **** of this ink will be conspicuous. And **** of this ink may cause and carry out degradation of image grace.

[0011] ** In order to reduce a blot of the above-mentioned ** and degradation of an image depended for getting twisted, be made not to carry out the regurgitation of the ink simultaneously from the nozzle which adjoined, and it is possible to make it not pile up ink by the same horizontal scanning of a recording head. For example, when the number of nozzles is 256 pieces, it stops alternately, and in one scan, 128 nozzles are driven and an image is recorded. In such a case, since the printing duty in one horizontal scanning of a recording head will become 50% temporarily supposing it records a solid image, the printing concentration in one horizontal scanning of a recording head will fall. On the other hand, in order to avoid lowering of printing

concentration, it is possible to carry out horizontal scanning of the recording head twice, but if it does so, chart lasting time will become long.

[0012] ** Since the recording head and the ink cartridge are prepared for every ink to be used when using shade ink, the number of recording heads and the number of ink cartridges increase, and there is a problem that a recording device is enlarged. For example, in using the ink of seven colors of a yellow Magenta, cyanogen black and a light Magenta, light cyanogen, and light yellow, the breadth of the head of 7 classification by color is needed. Moreover, since a load will increase in order for weight to also increase in connection with it and to make carriage drive if the number of a recording head and carriage increases, the need of using the big drive motor of torque, and the need for the complicated device for capping engine-performance maintenance of the cap prepared according to the number of recording heads are produced, and there is a problem that the cost for it increases. [much]

[0013] ** If the difference of the concentration between shade ink is large again when using shade ink, the rendering of gradation will not become linearity in the switch parts (bond part) of light ink and dark ink in a record image, but it will become easy to produce a false profile. Moreover, change of the graininess of an image and change of a color tone which were recorded will occur in the above-mentioned ink switch part, and will become an unnatural image. That is, gradation will become discontinuous according to the concentration difference of shade ink. Although there is the approach of recording by using low concentration ink, inside concentration ink, and high concentration ink etc. increasing the phase of concentration in order to solve such a problem, it is clear to promote the problem about above-mentioned enlargement more.

[0014] ** Into the ink jet recording device using shade ink, in the normal mode which records an alphabetic character, a table, etc., four colors of yellow Magenta, cyanogen black may be used, and six colors of yellow, and Magenta cyanogen, a light Magenta, light cyanogen and light yellow may be used in the high-definition mode which records photograph tone image quality etc. In such a case, although a black ink cartridge and a light ink cartridge are exchanged, exchange of such a cartridge has the problem of making a user applying time and effort.

[0015] ** Although ink discharge quantity must be controlled in order to make the diameter of a dot into desired magnitude when the diameter control system of a dot expresses gradation, it is difficult to control ink discharge quantity by this method, and the problem of being scarce in the repeatability of gradation.

[0016] Thus, to the approach of the conventional high-definition-izing, various technical problems like the above-mentioned ** - ** occur. From now on, it being the need at an ink jet recording device will be realizing improvement in the speed, low-cost-izing, the miniaturization of equipment, etc. in addition to the further high-definition-izing. Therefore, it is required to solve various technical problems like the above-mentioned ** - **.

[0017] Moreover, according to the above-mentioned ** - **, it turns out that it is difficult to realize high-definition-izing and improvement in the speed only by arranging the ink regurgitation nozzle which made the diameter of a nozzle small to high density. In order to obtain a high definition image, it is important to make the regurgitation ink formed into the small drop reach the target with a sufficient precision on a record medium, or for ink to get twisted, and to make it not highlight it as *****. Moreover, although it must carry out high [of the printing duty in one horizontal scanning of a recording head] for high-speed record, **** of ink is not conspicuous and desirable if densification of the nozzle is carried out too much.

[0018] Moreover, although its attention is mainly paid about the grace of the pattern image which has gradation nature above (gradation level is not fixed), it is necessary to also take into consideration the grace of images, such as an alphabetic character, a line, a table, a poster, etc. which does not have not only a pattern image but gradation nature in realizing high definition-ization (gradation level is fixed). That is, it is possible to give edge enhancement to images, such as an alphabetic character, a line, a table, and a poster, and to form a sharp and clear image. However, by the approach of the edge enhancement in above-mentioned JP 8-72236A, since ink discharge quantity of the edge section is made [many], it is possible that the edge section keeps by *****. Then, the sharp edge section cannot be formed. Moreover, when raising image grace by edge enhancement, about chart lasting time, it was not taking into consideration

conventionally. For example, since contiguity dots will spread if it records by the one pass when making [many] ink discharge quantity of the edge section and recording it, it is necessary to record by the multi-pass. Then, time amount starts and is not desirable beyond the need. Moreover, when recording alphabetic characters, such as a poster, since the alphabetic character of a poster is large, it requires time amount for smearing away the interior of an alphabetic character. Then, even if the edge section is recordable in a short time, the chart lasting time as the whole image will not start and be desirable. Therefore, it is necessary to devise not only the edge section but the recording method of the non-edge section. Thus, its attention was not paid to improvement in the speed although high definition-ization was in drawing by edge enhancement conventionally.

[0019] Images, such as an alphabetic character, a line, a table, and a poster, are also wanted to attain high definition-ization by recording a pattern image with high resolution and the number of high gradation, and recording vividly images, such as an alphabetic character, a line, a table, and a poster, from the above thing, and to also record a pattern image further at high speed.

[0020] This invention is made in view of the above-mentioned various technical problems, and it aims at offering the ink jet recording device and the record approach of having reconciled the both sides of high-definition-izing and improvement in the speed using the recording head which arranged the small nozzle of the diameter of a nozzle to high density.

[0021] Moreover, this invention aims at offering the ink jet recording device and the record approach which made it possible to enable an expression of smooth gradation by making the number of gradation of halftone increase without reducing output resolution, and to also reduce the granular feeling in the highlights section.

[0022] Moreover, this invention aims at offering the ink jet recording device which can realize high-definition-izing and improvement in the speed, and the record approach, without being accompanied by enlargement and a cost rise of equipment.

[0023] Moreover, this invention aims at offering the ink jet recording device and the record approach of forming in a short time for images, such as clear alphabetic character, line, table, poster, etc. which has the sharp edge section.

[0024] Moreover, this invention aims at offering the ink jet recording device and the record approach which made it possible to enable record of a pattern field with high resolution and the number of high gradation, and to also reduce the granular feeling of the highlights section.

[0025] [Means for Solving the Problem] This invention for attaining the above-mentioned object The recording head which has the nozzle train by which at least one liquid regurgitation nozzle for carrying out the regurgitation of the liquid which does not contain substantially at least one ink regurgitation nozzle and color material for carrying out the regurgitation of the ink containing color material adjoined in the predetermined direction by turns, and has been arranged is used. It is the ink jet record approach which records an image by carrying out the regurgitation of said ink and said liquid to said recorded media, making said recording head and recorded media scan relatively. The decision process which determines whether to record some [at least] fields in the image which should be recorded only in said ink, or record said field on the both sides of said ink and said liquid. When it has the record process which records said field based on the decision result by said decision process and records said field on the both sides of said ink and said liquid, at said record process Each of the liquid breathed out from the liquid regurgitation nozzle which adjoins the ink breathed out from a predetermined ink regurgitation nozzle and said predetermined ink regurgitation nozzle reaches the location where it differs on said recorded media. Said ink which reached the target and said liquid which reached the target are characterized by contacting on said recorded media.

[0026] Moreover, the recording head which has the nozzle train which at least one liquid regurgitation nozzle for carrying out the regurgitation of the liquid which does not contain substantially at least one ink regurgitation nozzle and color material for carrying out the regurgitation of the ink containing color material adjoined in the predetermined direction by turns, and has been arranged is used for this invention. It is the ink jet recording device which records an image by carrying out the regurgitation of said ink and said liquid to said recorded media.

making said recording head and recorded media scan relatively. A decision means to determine whether to record some [at least] fields in the image which should be recorded only in said ink, or record said field on the both sides of said ink and said liquid, It has the record control means which controls said recording head so that the record based on the decision result by said decision means is made. When recording said field on the both sides of said ink and said liquid, each of the liquid breathed out from the liquid regurgitation nozzle which adjoins the ink breathed out from a predetermined ink regurgitation nozzle and said predetermined ink regurgitation nozzle reaches the location where it differs on said recorded media. Said ink which reached the target and said liquid which reached the target are characterized by contacting on said recorded media.

[0027] Moreover, the recording head which has the nozzle train which at least one liquid regurgitation nozzle for carrying out the regurgitation of the liquid which does not contain substantially at least one ink regurgitation nozzle and color material for carrying out the regurgitation of the ink containing color material adjoined in the predetermined direction by turns, and has been arranged is used for this invention. It is the computer-readable storage with which the program which performs record control processing of the ink jet recording device which records an image by carrying out the regurgitation of said ink and said liquid to said recorded media was stored, making said recording head and recorded media scan relatively. Said program The decision process which determines whether to record some [at least] fields in the image which should be recorded only in said ink, or record said field on the both sides of said ink and said liquid. The generation process which generates record data based on the decision result by said decision process is included. When recording said field on the both sides of said ink and said liquid is determined. Each of the liquid breathed out from the liquid regurgitation nozzle which adjoins the ink breathed out from a predetermined ink regurgitation nozzle and said predetermined ink regurgitation nozzle reaches the location where it differs on said recorded media. It is characterized by generating said record data in said generation process so that said ink which reached the target and said liquid which reached the target may contact on said recorded media.

[0028] Moreover, the recording head which has the nozzle train which at least one liquid regurgitation nozzle for carrying out the regurgitation of the liquid which does not contain substantially at least one ink regurgitation nozzle and color material for carrying out the regurgitation of the ink containing color material adjoined in the predetermined direction by turns, and has been arranged is used for this invention. It is a program for controlling the ink jet recording device which records an image by carrying out the regurgitation of said ink and said liquid to said recorded media, making said recording head and recorded media scan relatively. The decision process which determines whether to record some [at least] fields in the image which should be recorded only in said ink, or record said field on the both sides of said ink and said liquid. The generation process which generates record data based on the decision result by said decision process is included. When recording said field on the both sides of said ink and said liquid is determined. Each of the liquid breathed out from the liquid regurgitation nozzle which adjoins the ink breathed out from a predetermined ink regurgitation nozzle and said predetermined ink regurgitation nozzle reaches the location where it differs on said recorded media. It is characterized by generating said record data in said generation process in said generation process so that said ink which reached the target and said liquid which reached the target may contact on said recorded media.

[0029] In addition, in this description, record ink is ink containing color material. Moreover, clear ink is a liquid which does not contain color material substantially, for example, is a liquid which consists of the remaining components which removed the color-material component from the above-mentioned record ink.

[0030] Moreover, in this description, the thing of the head whose pitch spacing of a nozzle is 1 / X inch is called head of Xdpi. For example, if pitch spacing of a nozzle is 1/1200 inch, it is the head of 1200dpi.

[0031]

[Embodiment of the Invention] Hereafter, the operation gestalt of this invention is explained to a

detail with reference to a drawing.

[0032] [Operation gestalt of ** 1st] drawing 1 is an outline block diagram of a recording head carried in an ink jet recording device applicable to this invention. A nozzle is the recording head (linear array mold recording head) 90 arranged linearly in detail, and it is the outline block diagram showing that the nozzle 93 for record ink regurgitation and the nozzle 95 for clear ink regurgitation are arranged by turns to the array direction of the nozzle. In addition, in the recording head shown by drawing 1, it is desirable that the endmost part of a nozzle serves as the nozzle 95 for clear ink regurgitation. It is because this cannot be realized if the endmost part of a nozzle is not the nozzle 95 for clear ink regurgitation when making two clear ink adjoin to one record ink dot.

[0033] Drawing 2 is drawing showing the configuration of the recording head unit 9 possessing two or more recording heads 90 shown in drawing 1. Drawing 2 (a) shows the case where the linear array mold recording head 90 shown by drawing 1 is arranged to a horizontal single tier, and is the head unit 9 equipped with each head (90 Y, 90M, 90C, and 90Bk) of four colors of (Yellow Y) (Magenta M) (cyanogen C) black (Bk). Moreover, drawing 2 (b) shows the case where the linear array mold recording head 90 shown by drawing 1 is arranged to a vertical single tier, and is equipped with each head (90 Y, 90M, 90C, and 90Bk) of four colors of (Yellow Y) (Magenta M) (cyanogen C) black (Bk) for this as well as drawing 2 (a). In addition, you may gain separate independence and the head 90 of each color as shown in drawing 2 (a) and (b) may be unified. In this operation gestalt, such a recording head unit 9 is carried in the ink jet recording device.

[0034] Drawing 3 is the outline block diagram of the ink jet recording device concerning this invention, and carries the recording head unit 9 shown in drawing 2 (a). Clear ink is supplied to the nozzle which the ink of each color is supplied, respectively from each ink tank corresponding to each nozzle for carrying out the regurgitation of the ink of yellow Magenta cyanogen black (it abbreviates to Following Y, M, C, and Bk), and carries out the regurgitation of the clear ink from a clear ink tank. In that case, in the head of each color, it is arranged so that the nozzle for record ink regurgitation and the nozzle for clear ink regurgitation may become by turns.

[0035] In drawing 3, recorded media 1 are pinched with the feed roller 2 through the conveyance rollers 4 and 5, and are conveyed in the direction of drawing Nakaya mark A with actuation of the vertical-scanning motor 3 connected with the feed roller 2. Moreover, as recorded media 1 are crossed, guide rails 6 and 7 are formed in parallel, along with these guide rails 6 and 7, carriage 8 is guided and the recording head unit 9 carried in carriage 8 is scanned by right and left.

[0036] A yellow, a Magenta, cyanogen, the recording heads 90Y, 90M, and 90C of four colors of black, and 90Bk are carried in carriage 8, and the ink which corresponds from the ink tank 12 of four colors to each recording head 90 of these, respectively is supplied. Moreover, clear ink is supplied to recording heads 90Y, 90M, and 90C and each of 90Bk from the clear ink tank 13.

recorded media 1 --- a part for print width and print width of each recording head --- smallness - although the intermittent feed only of the amount is carried out, when recorded media 1 have stopped, a recording head is scanned in the PQ direction, the ink droplet according to a picture signal is breathed out, and record is performed.

[0037] In addition, there are two kinds of ink jet printers, the line mold printer which records by carrying out vertical scanning only of the recorded material, and the serial mold printer which records while repeating horizontal scanning of a recording head and vertical scanning of recorded media, a part for width of face and it of the recording head after above-mentioned drawing 3 is an example of a serial printer, and carries out horizontal scanning of the recording head to the direction of a nozzle configuration perpendicularly (the PQ direction of drawing 3) mostly and record for 1 horizontal scanning is completed --- smallness --- it is recording because only an amount carries out vertical scanning of the recorded media in the direction of a nozzle configuration (the direction of A of drawing 3) and repeats this. Moreover, this invention is not restricted to this serial printer, and can be applied also to a line printer as shown in drawing 4.

That is, in the case of a line printer, a nozzle supplies record ink and clear ink for it to each of each color recording head, while only the recording width is arranged like drawing 4, and arranges the recording head (90 Y, 90M, 90C, and 90Bk) of each color along the direction of A of a record medium. And horizontal scanning of a recording head records on the direction of a nozzle

configuration, and a perpendicular direction (the direction of A of drawing 4) by carrying out vertical scanning of the recorded media, without carrying out.

[0038] In an ink jet recording device of a serial mold like above-mentioned drawing 3, as shown in drawing 5 (a), whenever it scans the recording head 90 which made two or more nozzles arrange in the direction of X, it performs image recording of width of face d and record of one line is completed, the intermittent feed of the recorded media is carried out to the direction of Y and hard flow which are shown in every [of a recording head 90 / a recording width], and drawing 5 (a). Record is performed by repeating in order of (1) which shows this scan to drawing 5, (2), and (3), moreover, it is shown in drawing 5 (b) — as — the width of face of a recording head — — smallness — image recording may be performed when only an amount carries out the intermittent feed of the recorded media to the direction of Y, and hard flow. In this case, multiple times and a recording head will carry out horizontal scanning of the same line top in a record medium. In addition, this drawing 5 (b) forms the image because recording head width of face carries out vertical scanning of the recorded media every [2 / 1 /] and a recording head carries out horizontal scanning of the same line top of recorded media twice. For example, the field B on recorded media is recorded by horizontal scanning of ** of a recording head, and horizontal scanning of **, and Field C is recorded by the scan of **, and the scan of **.

[0039] Here, an ink jet head applicable to this invention is explained in full detail. In this invention, it is optimal to use the bubble jet (trademark) head equipped with the exoergic resistance element. Moreover, the bubble jet head used in this operation gestalt can be manufactured using the process of the conventional manufacture approach. The manufacture approach of a bubble jet head is shown below. The approach which wiring for a heater element and heater elements is used, and a thin film technology is formed, for example on a silicon substrate as an approach of manufacturing a bubble jet head, and forms the groove face and common ink interior wall of ink passage, subsequently joins the bonnet of plates, such as other glass, and forms the regurgitation element which is the so-called body of a bubble jet head according to processes, such as photolithography, using the photopolymer which is resin further is learned. A filter pastes the common ink room inlet-port section, and this regurgitation element is fixed with PCB on a base plate. As for the electrical installation between a regurgitation element and PCB, approaches, such as wire bonding, are taken. Finally a front cover and an ink introduction member are fixed, and encapsulants, such as silicone resin, are filled up with a liquid dense and the airtight object. Drawing 6 — drawing 8 show the configuration of the above-mentioned bubble jet head.

[0040] Drawing 6 expresses the configuration of the regurgitation element for carrying out the regurgitation of the record ink of one color. On the silicon substrate 301, a heater element 303 and the wiring 302 for heater elements use a thin film technology, and are formed, and there are the groove face and the common ink interior wall 304 of ink passage which were further formed with resin, such as a photopolymer. The common ink inlet-port section which the glass plate 305 with which the common ink inlet-port section 307 opened on it has pasted up, and was prepared in the glass substrate 305 is covered with the filter 306 adhered to a glass plate.

[0041] Drawing 7 is the schematic diagram showing the configuration of a bubble jet head. Adhesion immobilization is carried out on the base plate 403 as a base material with which the regurgitation element 401 and PCB402 support a regurgitation element, and both are electrically connected by wire bonding 406. The front cover 404 by which the ink introduction member 405 and the regurgitation aperture 407 were attached in this is joined, and they are a liquid dense and the bubble jet head the thing into which silicone resin 501 was made to fill up with the airtight object is indicated to be to drawing 8. In addition, the approach of forming a slot with shaping of plastic-resin with ink-proof nature as an option which forms an ink jet head, and joining to a cover plate and forming ink passage may be used. Moreover, after forming the slot for passage formation as the another conventional formation approach of ink passage using the hardening film of a photopolymer so that JP.2-42689B may see, it is pasted up or stuck by pressing with a cover plate, and ink passage may be formed.

[0042] Although a bubble jet head applicable to this invention is manufactured using the process of the conventional head mentioned above, since the head for carrying out the regurgitation of

the record ink of one color is assumed, the ink of the same color is filled up with the conventional bubble jet head as shown in drawing 6 into passage and a common liquid room with the natural thing. However, since it is characterized by carrying out the regurgitation of the both sides of record ink and clear ink from the nozzle train in one recording head in this invention, with the configuration of ink passage as shown in drawing 6, this invention is unrealizable. Then, in this invention, it constitutes drawing 9 (a) — (c) So that passage may be shown. That is, record ink and clear ink were supplied by turns to the nozzle train which consists of two or more nozzles. Thus, in this invention, the ink jet head which has the nozzle train by which the nozzle for clear ink regurgitation for carrying out the regurgitation of the nozzle for record ink regurgitation and clear ink for carrying out the regurgitation of the record ink has been arranged by turns is used. In addition, drawing 9 is drawing showing an example of the liquid flow channel for supplying record ink and clear ink to a nozzle train by turns, and (a) is [a fluoroscopy front view and (c) of a fluoroscopy perspective view and (b)] side-face sectional views. Thus, an ink jet head applicable to this invention is a head from which it has the nozzle train by which the nozzle for record ink regurgitation has been arranged alternately as shown in drawing 1 or drawing 9, and the nozzle which adjoins the nozzle for record ink regurgitation is a nozzle for clear ink regurgitation.

[0043] It faces recording an image on a record medium using such an ink jet head, and the case where drive only a record ink regurgitation nozzle and only record ink is recorded on recorded media, and the case where drive the both sides of a record ink regurgitation nozzle and a clear ink regurgitation nozzle, and record ink and clear ink are recorded on recorded media are properly used in this invention according to the image which should be recorded. And when recording both record ink and clear ink, as shown in drawing 10 (a), at least one clear ink regurgitation nozzle which adjoins a record ink regurgitation nozzle and it in the same horizontal scanning of a recording head is driven [both]. By carrying out the regurgitation of the both sides of record ink and clear ink from a contiguity nozzle in the same horizontal scanning of a recording head, as record ink and clear ink are contacted with a sufficient precision on recorded media (mixing) and it is shown in drawing 10 (b), the coat area by the record dot can be extended. In addition, although a part for the core of an impact dot is thinly shown by drawing 10 (b) and below-mentioned drawing 14 (b), in order that this may explain plainly signs that record ink and clear ink only mixed, it is not only illustrating in this way, and the amount of [of an impact dot] core is not necessarily thin actually. Moreover, the head of 1200dpi is used in drawing 10.

[0044] As for the ink jet head used in this invention, the nozzle is arranged by high density so that **** (the record ink and clear ink which were breathed out from the contiguity nozzle in the same horizontal scanning should mix on recorded media) may also show. Usually, when it records using such a high density head, while there are various merits, there are some evils. This evil is explained briefly [below] using the head of 1200dpi as shown in drawing 11. Drawing 11 is the head of 1200dpi and can carry out the regurgitation of the record ink from all nozzles. If record ink was breathed out from the contiguity nozzle in the head shown in this drawing 11, the record dots which adjoin on recorded media as shown in drawing 11 (b) will lap. Although it will be satisfactory if contiguity dots only lap, when the contiguity dots pile up during the same horizontal scanning, the record dots will be liquefied and it will mix with them. Thus, when contiguity dots are liquefied and they mix, there is a possibility of a dot spreading and degrading image grace. This blot divides in an alphabetic character, thin drawing, etc. as which high resolution is required especially, and image grace is affected. Then, as mentioned above, it is making it not record a contiguity dot during the same scan, in order to earn time amount until the ink breathed out previously permeates into recorded media by the conventional recording method, and recording a contiguity dot during the next scan, and the blot by the lap of dots was reduced. That is, it was recording using the multi-pass method which carries out the multiple-times scan of the same field. Although image grace also improves since the above-mentioned blot will be reduced if it records by the multi-pass method instead, the count of a scan will increase, chart lasting time will also become long, as a result lowering of a recording rate will be caused.

[0045] Moreover, since the nozzle is arranged by high density, the head shown in drawing 11 has the evil in which it has big effect on image grace conspicuous [**** of regurgitation ink / tend]. Here, by comparing the case where the reason **** of regurgitation ink tends to be conspicuous is recorded with the head of 1200dpi and the head of 600dpi explains, so that the nozzle is arranged by high density. For example, when recording density is 1200dpi, the center-to-center dimension between contiguity dots is about 21 micrometers, and when recording density is 600dpi, suppose that the center-to-center dimension between contiguity dots is about 42 micrometers. And if the diameter of a dot is about 20 micrometers, at 1200dpi, an image is formed by arrangement which a contiguity dot meets with, and on the other hand by 600dpi, an image will be formed, without contiguity dots touching. When recording on the above conditions, when the impact location of a dot shifts "Regurgitation ink should get twisted and be alike", in 1200dpi, fluctuation [comparatively / (rate of a white ground)] of the part which is not covered with a dot is large. That is, if the impact location of a dot shifts, a white ground may occur by this which will not overlap a contiguity dot too many. On the other hand, in 600dpi, since contiguity dots do not overlap from the first, even if an impact location shifts somewhat, fluctuation of the rate of a white ground is not so large. That is, since a contiguity dot does not overlap even if an impact location shifts somewhat, it is rare for a white ground to newly occur. This shows that degradation of the image grace of regurgitation ink depended for getting twisted tends to be conspicuous, so that the nozzle is arranged by high density.

[0046] It is necessary to devise so that the above-mentioned blot and degradation of image grace depended for getting twisted may be reduced when recording using such a high density head since a blot and degradation of image grace depended for getting twisted tend to be conspicuous from the above thing so that the nozzle is arranged by high density. So, in this invention, the regurgitation of the record ink is carried out [not all] from the nozzles in a nozzle train, but it is made to carry out the regurgitation of the record ink from the nozzle in every other one. If it puts in another way, it constitutes from a nozzle which adjoins the nozzle for record ink regurgitation so that the regurgitation of the record ink cannot be carried out, and as shown in drawing 1, the nozzle for record ink regurgitation is arranged alternately. By recording using such a head, a blot and the above-mentioned evil "depend" of a dot can be reduced. It is because the contiguity dots recorded do not contact even if it will drive all the nozzles for record ink regurgitation in the head of 1200dpi as shown in drawing 12 if the nozzle for record ink regurgitation is arranged alternately, so the evil resulting from the densification of a nozzle which was explained above is not produced.

[0047] Thus, in this invention, while the diameter of a nozzle makes it possible to record the image of high resolution by using the head which arranged the small nozzle to high density, it makes it possible to avoid the above-mentioned evil in a high density head in arranging the nozzle for record ink regurgitation alternately. In addition, since record ink is breathed out from the nozzle in every other one using the head of 1200dpi in the above-mentioned example, it will record with the recording density of 600dpi as a result, therefore --- although resolution will fall compared with recording with the recording density of 1200dpi --- instead, a blot of a dot --- getting twisted --- etc. --- since degradation of the originating image grace can be reduced, this gentleman is desirable even if it reduces resolution. Moreover, generally, considering the viewpoint of obtaining a high-definition image, the resolution of 600dpi is sufficient resolution and can be called image of high resolution.

[0048] In this invention, an ink regurgitation nozzle as shown in drawing 1, and a clear ink regurgitation nozzle are using the recording head of the inline type which has the nozzle train arranged by turns, and are breathing out record ink and clear ink from the same head. The direction of an inline-type head of this reason is because impact precision is high. It is because it is not influenced of the difference in the thermal expansion which in the case of the same head is produced because heads differ. When a record ink regurgitation nozzle and a clear ink regurgitation nozzle are another heads, and each head expands thermally according to environmental temperature, specifically, a gap may arise in the relative physical relationship of a nozzle. In this case, a clear ink dot cannot be made to reach the target with a sufficient precision between record ink dots. On the other hand, since in the case of the inline-type head

which the record ink regurgitation nozzle and the clear ink regurgitation nozzle arrange with inline one it is changeless to the relative physical relationship of each nozzle even if it expands thermally, a clear ink dot can be reached the target with a sufficient precision between record ink dots. Therefore, in this invention, it is desirable to use the inline-type head which is not influenced of the difference in the thermal expansion produced because heads differ.

[0049] Moreover, clear ink is made to reach the location which adjoins a record ink dot like the after-mentioned in this invention. The direction made to reach an adjoining location becomes drawing 46 and drawing 47. Drawing 46 is drawing which made 1 dot of record ink, and 1 dot of clear ink reach recorded media. (a) is the case where record ink and clear ink are made to reach an adjoining location, and (b) is the case where record ink and clear ink are made to reach the same location. Dot area is large rather than it makes a location [made / to reach the location which will adjoin from now on so that clearly / the same] reach. This originates in diffusion of ink. That is, since the record ink and clear ink which were made to reach an adjoining location are united with the inside of a short time and it spreads in the XY direction on a recorded-media front face, the dot area at this time becomes large a little rather than the sum of each dot area of a record ink dot and a clear ink dot. If record ink and clear ink are made to reach the same location, since the diffusing capacity to the Z direction (the thickness direction of recorded media) of ink will become large on the other hand, dot area becomes smaller than the time of making an adjoining location reach.

[0050] Drawing 47 shows that solid printing is performed on the both sides of record ink and clear ink, and a dot is developed by two-dimensional as shown in drawing. When a record ink dot and a clear ink dot are made to reach the same location, depending on the diffusion to recorded media, and correlation of the diameter of a dot, a clearance may be and vacant between dots like drawing 47 (b). Therefore, it is desirable to make record ink and clear ink reach an adjoining location in this invention which performs solid printing in record ink and clear ink.

[0051] By the way, although the image of high resolution is recordable if it records in the ink formed into the small drop as above-mentioned technical-problem **--** also described, when recording a solid image on recorded media, chart lasting time will become long, and a recording rate will be reduced. Then, in this operation gestalt, it is supposed that only record ink performs image recording when high resolution records a required image, and image recording is performed on the both sides of record ink and clear ink when resolution records an unnecessary solid image.

[0052] First, the 1st recording mode only using record ink is explained using drawing 13. This 1st recording mode is applied when recording the image with which the high resolution of an alphabetic character, a thin line, etc. is demanded. This drives only a record ink regurgitation nozzle and a clear ink regurgitation nozzle is realized by making it not drive. By carrying out like this, as shown in drawing 13, only a record dot is formed on recorded media. Since the probability, as for the image which consists of only this record dot, for contiguity dots to lap is low, there are little the blot and the effect of getting twisted of a dot, and since it is also high resolution, it can be said that it is the high image of grace. Moreover, if the 1st recording mode is used for the edge sections as which high resolution is required especially, such as an alphabetic character and a thin line, since it exists after the dot has become independent, and an edge is emphasized, it is effective.

[0053] Next, the 2nd recording mode using the both sides of record ink and clear ink is explained using drawing 10 and drawing 14. Drawing 10 is drawing showing the case where it records based on the recording mode which uses the both sides of record ink and clear ink, it is shown that (a) drives at least one nozzle for clear ink regurgitation both which adjoins the nozzle for record ink regurgitation and it, and (b) shows signs that the record ink dot and clear ink dot which reached the target on recorded media have mixed. Moreover, it is drawing showing the case where drawing 14 also records based on the recording mode using the both sides of record

ink and clear ink, and it is shown that (a) drives both two nozzles for clear ink regurgitation that adjoin the nozzle for record ink regurgitation and it, and (b) shows signs that the record ink dot and the clear ink dot which reached the target on recorded media contact, and the dot of the both sides mixes. This 2nd recording mode is effective when recording a solid image with unnecessary resolution especially. When recording a solid image by the 2nd recording mode of the above, it realizes by driving drawing 10 (a) and all the nozzles in the head of drawing 14 (a). [0054] And in order are liquefied and to make it mix with the record ink and clear ink which are breathed out, it is desirable to carry out the regurgitation of record ink and the clear ink by the same horizontal scanning of a recording head. Thus, the liquid breathed out from the liquid regurgitation nozzle which adjoins the ink breathed out from the predetermined ink regurgitation nozzle and a predetermined ink regurgitation nozzle reaches the location where it differs on recorded media, in order that record ink and clear ink may be liquefied and may mix on recorded media because record ink and a liquid contact on recorded media, a record ink dot can extend in clear ink, and the coat area of a record ink dot becomes large. By carrying out like this, it becomes possible to record a solid image for a short time.

[0055] Here, when recording a solid image, why it is effective making it mix with record ink and clear ink is explained. First, it is because chart lasting time can be shortened [1st]. As mentioned above, since adjoining record ink dots do not overlap, one scan of a recording head cannot cover the predetermined field in recorded media by this invention thoroughly at a record ink dot. That is, in one horizontal scanning (one pass), between record ink dots, a clearance is vacant and a solid image cannot be recorded. Temporarily, if it is going to record a solid image only by the record dot using the head of this invention, it must record by the multi-pass method, chart lasting time will be long, and it will keep. Then, it enables it to record a solid image by one horizontal scanning of a recording head by making it mix with record ink and clear ink, and enlarging coat area of record ink. It is because record concentration can be made high the 2nd. When it is going to record a solid image only by the record ink dot using the head of this invention, in one scan of a recording head, between contiguity dots, a clearance will be made and record concentration will become low. Then, lifting of record concentration is in drawing by making it mix with record ink and clear ink, and enlarging coat area of record ink. As mentioned above, in order to record the solid image which has sufficient record concentration for a short time, it is made to mix with record ink and clear ink in this invention.

[0056] Although it will explain that record concentration rises by the above-mentioned explanation if record ink and clear ink mix, this is explained in full detail. If record ink and clear ink mix, the color material of record ink will be spread in clear ink, and a record ink dot will be thinned. Thus, since the area of a record ink dot will spread by being thinned although it is thought that the optical density of a record ink dot falls if a record ink dot is thinned, optical density does not necessarily fall just because it was only thinned. That is, the optical density of a record ink dot is not determined by only the absolute magnitude of the color material per unit area, but the coat area of the record dot on a record medium influences greatly actually. [0057] For example, this is understood from drawing 15. Drawing 15 is drawing in which solid optical density shows the relation of the dot coverage and optical reflection density (OD value) in the 1st ink of Ds, and the ink whose solid optical density is two kinds of the 2nd ink of Ds/2. In addition, an axis of abscissa is the coverage by the dot, and an axis of ordinate is OD value. This drawing 15 shows that it is [OD value] higher to realize 100% of coverage in the 2nd ink rather than the 1st ink realizes 50% of coverage. (This is clear from the OD value of a B point being larger than OD value of an A point.) namely, drawing 15 --- concentration --- the record ink dot of "1" --- area --- rather than it forms "1" --- concentration --- record ink "one half of dots" --- area --- it is shown that it is [OD value] higher to form "2". The above thing shows that optical reflection density is not determined by only the concentration of ink itself, and coat area is greatly applied.

[0058] Lifting of optical reflection density of this invention is in drawing using this principle. When one record ink dot and one clear ink dot are made to mix, the ink concentration after mixing is average 1 [about] / 2 to the concentration of record ink, and the ink coat area after mixing serves as a twice [about] as many average as this to the coat area of only a record ink dot. In

this case, if dot coverage increases so that clearly from the formula (Dreflected-light study concentration, n:constant, a:dot coverage, Ds: solid reflected light study concentration) of following Yule-Nielsen, reflected light study concentration becomes high and looks deep. In this invention, by striking a clear ink dot and making it spread between record ink dots, it is raising dot coverage and makes it possible to record the image which has optical reflection density higher than the optical reflection density only by the record ink dot.

[0059]

[External Character 1]

$$\text{Yule - Nielsen 式 } D = n \log \frac{1}{1 - 10^{-\frac{1}{2aD_s}}}$$

[0060] Although the recording rate is thought as important and one-pass record is enabled especially in the 1st recording mode of the above, since contiguity dots will not touch if it records by the one pass, a clearance is made between dots, and the grace of an image may fall by the clearance and it may be visible. Then, what is necessary is just to record on the 1st recording mode using the recording method which applied the multi-pass method to record an image with more high grace. The image with which only record ink is breathed out by the one-pass eye, and a contiguity dot does not touch is formed like the 1st recording mode concrete first. Next, after conveying recorded media in the direction of vertical scanning, only record ink is breathed out so that between the dots recorded by the one-pass eye in the two pass eye may be complemented. It becomes possible by doing in this way to record the image of high resolution without a clearance between dots, and high definition-ization can be attained rather than it records by the 1st recording mode. Let the recording method which applied this multi-pass method be the 3rd recording mode. In addition, if this 3rd recording mode is applied, while-izing can be carried out [high definition] rather than the 1st recording mode, lowering of a recording rate will be caused. For example, if a number of passes is made into 2 times, chart lasting time will take 3 or more times, if it is made into more than twice and 3 times. What is necessary is just to use properly by the case where the case where a recording rate is thought as important in consideration of this, and record grace are thought as important, since there is an advantage in the 1st recording mode and 3rd recording mode as mentioned above.

respectively. Moreover, let the recording method which applied the multi-pass method to the 2nd recording mode be the 4th recording mode. The 4th record MORT is used with the 3rd record MORT. It is because both modes are multi-passes and can double a number of passes by this. In addition, even if it is a time of recording by the 4th recording mode, the record ink and clear ink which are breathed out from a contiguity nozzle are breathed out by the same horizontal scanning of a recording head.

[0061] Thus, it is possible to record with this operation gestalt by the 1st recording mode, the 2nd recording mode, the 3rd recording mode, and the 4th recording mode, and, as for which recording mode is used, it is desirable to determine according to an image, a user's selection, etc. which should be recorded. With the 1st operation gestalt concerning this invention, it is characterized by carrying out using the 2nd recording mode to the solid field of an image with unnecessary resolution using the 1st recording mode to the non-solid field where resolution is demanded. This is explained in full detail below using drawing 16 - drawing 19.

[0062] Drawing 16 is the block diagram of the ink jet recording apparatus 100 shown in drawing 3. Image data, such as an alphabetic character which should be recorded from a host computer 1710, and a line drawing, a photograph tone, is inputted into the receive buffer 1601 of a recording apparatus 100. Moreover, the data which check whether data are transmitted correctly, and the data which tell the operating state of a recording apparatus 100 are transmitted to a host computer from a recording apparatus 100. The data of a receive buffer 1601 are transmitted to the bottom of management of CPU1602 at the memory section 1603, and are temporarily memorized by RAM (random access memory) of the memory section 1603. The mechanical-completion trawl section 1604 carries out actuation control of the mechanisms 1605, such as a carriage motor and a line-feed motor, by the command from CPU1602. A sensor / SW control section 1606 sends various sensors and the signal from a sensor / the SW

section 1607 which consists of SW (switch) to CPU1602. The display device control section 1608 controls the display device section 1609 which consists of LED, a liquid crystal device, etc. of a display-panel group by the command from CPU1602. The recording head control section 1610 controls recording heads 90Y and 90M, 90C, and 90Bk by the command from CPU1602. For example, according to selection of image data or a user, the case where only the nozzle for record ink regurgitation in each head is driven, and the case where the congruence of the nozzle for record ink regurgitation and the nozzle for clear ink regurgitation is driven are controlled, and an image is formed by driving a nozzle selectively. Moreover, the recording head control section 1610 detects the temperature information which shows the condition of the above-mentioned recording head, and tells them to CPU1602.

[0063] Drawing 17 is the block diagram showing the configuration of the control system of a host computer 1710. In drawing 17, 1710 is a host computer, for example, a personal computer, and MPU by which 1700 controls each part, read-only memory ROM in which 1701 stored various kinds of programs of operation, and 1702 are the memory RAM in which write-in read-out is possible. The image-processing section in which 1704 performs an image processing at large, and 1705 are solid field detecting elements which detect the solid field of an image, and 1707 is a control unit for performing the input of various keys, the display of a message, etc. A host computer 1710 is controlled by MPU1700 which operates based on the program stored in ROM1701. The program for performing processing shown with the flow chart of drawing 19 which the graphic subsystem which mediates a printer driver, and the application program and printer driver for driving the application program and printer which control a document processing system program etc. is contained in ROM1701, and starts this operation gestalt is also stored. Moreover, picture-input-device 150 grades, such as the ink jet recording apparatus 100, a scanner, and a digital camera, are connected to the host computer 1710 through the interface section 1603.

[0064] Drawing 18 is the block diagram showing the configuration of the solid field detecting element 1705. With this operation gestalt, as shown in drawing 17, the solid field detecting element 1705 is provided independently, but a solid field may be detected after making reading data binary for example, even if it prepares in the interior of the image-processing section 1704. The detection approach of the solid field in this operation gestalt is explained below. A manuscript image is read with a scanner and the case where the black solid field in a manuscript image is detected is shown especially here.

[0065] Detection of a black solid field is performed [how much a black pixel exists continuously]. The number of the black pixel in one line of a manuscript image is counted, if that number is more than a predetermined threshold, that line will be made into the candidate of a solid field, and, specifically, this candidate line will make from the initiation line of fixed line ***** to a termination line a black solid field.

[0066] Drawing 18 is a block diagram at the time of constituting the solid field detecting element 1705 using the above-mentioned detection approach, and consists of a comparator 201, DF/F (D type flip-flop)202, the enabling counter 203, a comparator 204, a line counter 205, a selector 206, DF/F207, and DF/F208. In the solid field detecting element 1705, the multiple-value image data inputted from picture input devices, such as a scanner and a digital camera, is first made binary in bilingual processing images with a comparator 201 as compared with Threshold1 (threshold). DF/F202 inputs the data made binary, and if a black pixel carries out predetermined pixel continuation, it will output High from an output B. The enabling counter 203 counts the count of this High output, and outputs the number of black pixels around [one line] based on a line clock. If a comparator 204 is beyond the value of Threshold2 about the number of black pixels around [one line] as compared with Threshold2 (threshold), it latches the Y coordinate at that time by DF/F207. The value which exceeded Threshold2 first at this time is memorized as Y1. Then, the value of a Y coordinate is updated and Yn is obtained until a line counter 205, a selector 206, DF/F207, and DF/FY1 are set to Low by 208. That is, between Y1-Yn(s) serves as a black solid field. In addition, it is also possible not to be restricted to this, although the case where a black solid field was detected above was explained, but to also detect the solid field of other colors (Yth grade). For example, when detecting C solid field in C ink, it can detect by paying one's

attention to C pixel.

[0067] Actuation of the 1st operation gestalt realized using the above configuration is explained using the flow chart of drawing 19. Drawing 19 shows the processing which controls the case (the 2nd recording mode) where the both sides of the case (the 1st recording mode) where only record ink is used, record ink, and clear ink are used according to image data, and this processing is performed when MPU1700 controls each part 1701-1705. First, in step S1, a manuscript is read by the picture input device (scanner) 150, and an image input is performed. Next, in step S2, the solid field in the read reading image data is detected by the solid field detecting element 1705. If it is a solid field, it will progress to step 3, and it sets up so that the solid field may be recorded by the 2nd recording mode of the above. That is, the field judged to be a solid field is recorded using the both sides of record ink and clear ink. If the 2nd recording mode is set up at step S3, the record image data for recording said solid field in step S4 will be created. Let the data obtained here be Data A. Then, it progresses to step S7.

[0068] On the other hand, if it is the non-solid field which is not a solid field, it will progress to step S5, and it sets up so that the non-solid field may be recorded by the 1st recording mode of the above. That is, the field judged to be a non-solid field is recorded only using record ink. If the 1st recording mode is set up at step S5, the record image data for recording said non-solid field in step S5 will be created. Let the data obtained here be Data B. Then, it progresses to step S7. [0069] In step S7, the data of a solid field and the data of a non-solid field are combined. A theoretical product with the data B obtained in order to record Data A and the non-solid field which were specifically obtained in order to record a solid field is taken, and let this be record data.

[0070] Thus, the obtained record data are transmitted to the ink jet recording apparatus 100 through the interface section 1603, and record is performed by the ink jet recording apparatus. The record image which recorded the non-solid field only in record ink, and recorded the solid field on the both sides of record ink and clear ink by the above is formed.

[0071] In addition, although detection of the solid field mentioned above was performed to the image data inputted from the picture input devices 150, such as a scanner digital camera, a solid field is detected as well as the above when recording an alphabetic character, a photograph, etc. which are displayed on the monitor which is the display of a host computer 1710. In this case, what is necessary is just to detect a solid field by the same approach as the above, after changing the image data of a multiple value into binary data.

[0072] Moreover, the detection approach of a solid field is not limited to the above-mentioned approach, and can use well-known various approaches. For example, how a profile trace detects a solid field may be adopted. This approach is explained using drawing 20 - drawing 21.

[0073] First, the raster scan of the image data is carried out on RAM in which the image data which should be recorded is stored, and the pixel which starts a trace is discovered. Next, in the case of an outside border line, it pursues counter clockwise from the trace initiation pixel, and, in the case of an inside border line, a profile pixel is pursued clockwise. And it has having returned to the trace initiation pixel again, and a trace of the border line of one pixel set is completed. It performs repeatedly until the profile pixel whose above scan is not pursued is lost.

[0074] Drawing 20 is taken as the direction of 0-7 as shown the example which pursued the border line of one pixel set and shown in drawing 21 as a direction of a border line. First, supposing it carries out a raster scan like the sketch of drawing 20, and it looks for trace initiation, for example, a trace initiation pixel is found in the location of (i1, j1), the pixel in front of [at the time of a raster scan] one will judge that it is a white pixel and is an outside border line, and will start a trace counterclockwise from this location. Next, a trace is started counter clockwise from the direction of "4" of drawing 21. A nearby pixel is investigated counter clockwise from the direction of "4", and the direction of the pixel found first is made into the direction of a border line. Subsequently, a trace core pixel is moved to the pixel, and a pixel will be investigated counter clockwise from the direction of the last border line (the direction of "2") soon, and it repeats until this arrives at a trace initiation pixel. A border line as shown by the arrow-head group of drawing 20 by performing such processing is obtained.

[0075] Thus, the data of the obtained border line are stored in RAM, after that, this border-line

data is a solid field, or how judges. As this decision technique, it is carried out by counting the number of pixels in a border line. Specifically, the number of pixels which continues in the direction of X is counted first. The count is performed by jN line. For example, by drawing 20, it counts [j line] in ... and order five pixels at three pixels j the 2nd line (counting). Next, the threshold beforehand decided to be the total number of the number of count pixels is compared, and when the total number is larger, the inside of a border line is judged to be a solid field. On the other hand, when the total number is smaller, it is judged as a non-solid field. That is, by detection of this solid field, it judges whether it is a solid field by whether the area in a border line is larger than the threshold decided beforehand. Like the above, when judged as a solid field, the 2nd recording mode is set up, and when judged as a non-solid field, the 1st recording mode is set up.

[0076] In addition, as mentioned above although [the 1st operation gestalt] each processing of detection of a solid field, setting out of a recording mode, etc. is performed by the host computer 1710 side, said each processing may be performed by the printer side by storing the program for performing said each processing in the memory section of a printer. Moreover, although MPU1700 is made to process by the program which stored this the processing of each in ROM1701 in drawing 17 by software, the circuit of the dedication for performing this processing of each is established in a printer side, and you may make it hardware constitute from the 1st operation gestalt.

[0077] According to this operation gestalt, it faces recording an image using the high density head by which the nozzle for record ink regurgitation and the nozzle for clear ink regurgitation have been arranged by turns as mentioned above. It is recording the solid field where resolution's is not demanded on the both sides of record ink and clear ink, and recording the non-solid field where resolution's is demanded only in record ink. Moreover, a solid field can be formed by sufficient printing concentration, without reducing a recording rate, and a non-solid field can be formed with high resolution. Therefore, record of an image with high resolution is attained by using this operation gestalt for a short time. furthermore — since the blot by the record ink dot can be reduced since the record ink dots of a head constitutionally breathed out in the same horizontal scanning do not adjoin, and high resolution-ization is carried out too much [necessarily] — a regurgitation ink dot — also getting twisted — it can be made hard to be conspicuous.

[0078] [2nd operation gestalt] Next, the 2nd operation gestalt of this invention is explained. With this 2nd operation gestalt, it is characterized by recording an alphabetic character field by the 1st recording mode, and recording a pattern field (ungrammatical sentence character field) by the 2nd recording mode. It explains especially here taking the case of the case where the image with which the alphabetic character field and the pattern field were intermingled is recorded. In addition, in order to explain this operation gestalt, drawing 17, drawing 18, and drawing 22 are used.

[0079] Drawing 22 is a flow chart which shows the procedure of the 2nd operation gestalt, and the program for performing this processing is stored in ROM1701 of drawing 17. Moreover, the flow chart shown in drawing 22 is performed by MPU1710.

[0080] First, in step S1, a manuscript is read by the picture input device 150, and an image is inputted. It is a full color image like the GURABIRA journal which has as a manuscript the multi-colored picture image with which the alphabetic character field and the pattern field were intermingled, for example, and the full color image read by the picture input device 150 is changed into digital data, and is inputted into a host computer 1710 through the interface section 1703 as multiple-value image data of R-G-B. Next, it was inputted in step S2. The multiple-value image data of R-G-B is the image-processing section 1704, and is changed into the binary data of Y-M-C-Bk in which an output is possible with the ink jet recording apparatus 100. Then, in step S3, the alphabetic character judging of whether to be an alphabetic character is performed to each Y-M-C-Bk data made binary.

[0081] If it is the alphabetic character field which is an alphabetic character, it will progress to step S4, and the alphabetic character field is set up so that the 1st recording mode may be recorded. That is, the field judged to be an alphabetic character field is recorded only in record

ink. If the 1st recording mode is set up by step S4, the record image data for recording said alphabetic character field in step S5 will be created. Let the data obtained here be Data C. Then, it progresses to step S8.

[0082] On the other hand, if it is the pattern field which is not an alphabetic character, it will progress to step S6, and it sets up so that the pattern field may be recorded by the 2nd recording mode. That is, the field judged to be a pattern field is recorded using the both sides of record ink and clear ink. If the 2nd recording mode is set up at step S6, the record image data for recording said pattern field in step S7 will be created. Let the data obtained here be Data D. Then, it progresses to step S8.

[0083] In step S8, the data of an alphabetic character field and the data of a pattern field are combined. A theoretical product with the data D obtained in order to record Data C and the pattern field which were specifically obtained in order to record an alphabetic character field is taken, and let this be record data.

[0084] Thus, the obtained record data are transmitted to the ink jet recording apparatus 100 through the interface section 1603, and record is performed by the ink jet recording apparatus. The record image which recorded the alphabetic character field only in record ink, and recorded the pattern field on the both sides of record ink and clear ink by the above is formed.

[0085] Here, the alphabetic character judging of step S3 in drawing 22 is explained. It performs with procedure as specifically shown with the flow chart of drawing 23. First, the value of Counter L is set to "1" in step S1. Next, in step S2, as shown in drawing 24, it asks for the 1-dimensional projection data of the direction of X from the binary data of the color currently observed. And in step S3, as shown in drawing 25, the data configuration (width of face W, spacing B, height H, sharpness H'/dx) of the 1-dimensional projection data is measured.

[0086] In step S4, it judges whether it is an alphabetic character by comparing the width of face W which it is as a result of [of a configuration] measurement, spacing B, height H, and sharpness H'/dx with the reference value set up beforehand. For example, since an alphabetic character making a line and being printed is most, an alphabetic character can be judged from the width of face W of the direction projection data of X, and height H, namely, the width of face W of data and height H — abbreviation — if the same, the field will be judged to be an alphabetic character field. In this way, an alphabetic character judging is performed. In addition, steps S2 and S3 which perform an alphabetic character judging, and S4 may be performed by analyzing approaches other than this, for example, the frequency distribution of the run length shown by drawing 26, (drawing 27).

[0087] Here, the reason for recording a pattern field on the both sides of record ink and clear ink, and recording an alphabetic character field only in record ink is explained. This is because there is gradation nature in a pattern field and there is no gradation nature in an alphabetic character field on the other hand. Generally, there is gradation nature in pattern fields, such as a photograph, and said pattern field is formed by recording the multi-gradation data with which gradation level differs. Therefore, to record a pattern field, it is required to perform a gradation expression. In order to obtain a more nearly high-definition image especially, the direction with many gradation which can be expressed is desirable. Therefore, in this operation gestalt, since it is suitable for performing a high gradation expression, in recording a pattern field, it supposes that the both sides of record ink and clear ink will be used. On the other hand, an alphabetic character is not recorded on fixed gradation level, and it does not need a gradation expression. Therefore, in recording the alphabetic character field which does not need a gradation expression, it uses only record ink. An alphabetic character with clearer recording an alphabetic character only in record ink can be formed.

[0088] The number of gradation which can be expressed by using the both sides of record ink and clear ink with this operation gestalt is made to increase, as mentioned above, and formation of a high-definition pattern field is enabled. Here, the reason which the number of gradation which rather than can express [which used the both sides of record ink and clear ink] increases is explained using drawing 28 — drawing 33 only using record ink.

[0089] Drawing 28 is drawing having shown signs that the coat condition of a record dot changed by contacting the record dot and clear ink in record ink. In drawing 28, 2801 expresses the

cross section of a record medium and the record dot to which 2802 reached the record medium, and the clear ink given as a record dot touched in 2803 are shown. Moreover, drawing 28 (a) is the case where only a record dot is recorded on a record medium, drawing 28 (b) is the case where clear ink is recorded on a record dot in piles at (T3) after making the record dot reach the target and sufficient time amount has passed, and drawing 28 (c) is the case where clear ink is recorded immediately (T2) in piles, after making a record dot reach the target. Moreover, Da, Db, and Dc show the optical reflection density of the record dot by the record conditions of drawing 28 (a), drawing 28 (b), and drawing 28 (c), respectively. In addition, Da, Db, and Dc are measured in time amount T four after sufficient time amount passes from the time amount T2 and T3 which the time amount T1 which the record dot was made to reach, and clear ink were made to reach. That is, after change of the coat condition of the record dot in clear ink finishes, it has measured.

[0090] In drawing 28 (b), since clear ink is put on the record dot after making a record dot reach the target and sufficient time amount passes, the coat condition of a record dot hardly changes. Therefore, the case where the coat condition of a record dot makes only a record dot reach the target like drawing 28 (a) and abbreviation — it is the same. On the other hand, in drawing 28 (c), since clear ink is breathed out before ink permeates thoroughly in a record medium, a record dot spreads in clear ink. In such a case, optical reflection density is $D_a = D_b < D_c$. With this operation gestalt, it uses that optical reflection density serves as $D_a = D_b < D_c$ according to the above-mentioned record conditions. That is, it uses that optical reflection density increases with the increment in the coat area by the record dot.

[0091] Although this operation gestalt is making the coat area of a record dot increase in clear ink as mentioned above, this operation gestalt makes the number of gradation which can be expressed by using this increase, and is enabling the expression of more smooth gradation. This is explained using drawing 29.

[0092] Drawing 29 is a dot pattern which has arranged the record dot and the clear ink in a dot matrix. The optical reflection density at the time of printing four record dots in the dot matrix of 4x4 like drawing 29 (a) like D1 and drawing 29 (b) If optical reflection density at the time of printing eight clear ink dots for the optical reflection density at the time of printing four clear ink dots near the four record dots near the four record dots like D2 and drawing 29 (c) is set to D3, these will become the relation of $D1 < D2 < D3$. This is considered that the relation of the magnitude of the record dot which reached the target on recorded media (adhesion), a configuration, and coat area, the osmosis mechanism inside a record medium, etc. have influenced, and it is thought that the phenomenon of raising covering effect because especially a dot configuration expands the diameter of a breadth dot to width on a record-medium front face arises, and piling of the concentration is carried out.

[0093] When expressing a gradation value with concentration higher one step generally than the gradation value of the dot pattern which has arranged four record dots in a dot matrix like drawing 29 (a), five record dots are arranged in a dot matrix like drawing 29 (d). If optical reflection density of this drawing 29 (d) is set to D4, the relation of optical reflection density will serve as $D1 < D4$ with a natural thing. Conventionally, although the ink of one concentration was not able to express gradation between D1 and D4, with this operation gestalt, the gradation between D1 and D4 is expressed using there being the above D2 or D3 in the medium of D1 and D4, i.e., the relation of optical reflection density being $D1 < D2 < D3 < D4$. Thus, the number of gradation which can be expressed is made to increase. Moreover, in order to acquire the halftone which has the optical reflection density between D1 and D4, it is not that what is necessary is just to merely add clear ink blindly. Since optical reflection density changes with numbers of clear ink dots made to reach the target so that the relation between D2 and D3 may show, halftone must be expressed by controlling, the amount, i.e., number of clear ink dots, of the clear ink contacted to a record dot. It becomes possible to obtain the desired number of gradation by changing the number of clear ink dots made to reach the target.

[0094] If the situation of the record dot containing the color material on a record medium is observed, it is rare that the record dot which reached the record-medium front face is a perfect circle, usually — becoming the form of paper where color material sank in along with fiber, for

example, on a regular paper (PPC form) **** — space — if there is also a part which has permeated deeply, there will also be a part which is blurred on the front face and it will be a very complicated configuration. That is, on the record-medium front face, the complicated configuration is presented as the record dot. If the above-mentioned clear ink is made to adhere to the location which adjoins the record dot which has such a complicated configuration, the configuration of a record dot will change on space. Color material will sink in more mostly along with the fiber of space, and, specifically, amplification of the diameter of a dot will be observed. Moreover, when the boundary part of a dot spreads, the effectiveness of reducing the granular feeling of the record dot in the highlights section also shows up.

[0095] This operation gestalt is carrying out a gradation expression by the dot of the both sides of a record dot and a clear ink dot, and is making the number of gradation which can be expressed rather than it carries out a gradation expression only by the record dot increase as mentioned above. For example, as shown in drawing 30 and drawing 31, when expressing a gradation value using the dot matrix of 4x4, the dot pattern for 16 gradation value can usually be considered like drawing 30 (a) and drawing 31 (a). However, when carrying out a gradation expression by the dot of the both sides of a record dot and a clear ink dot, the expression of 25 gradation is attained like drawing 30 (b) and drawing 31 (b). In addition, drawing 30 (b) and drawing 31 (b) are the cases where the gradation value is adding clear ink to the dot pattern below "16." Thus, by supposing that clear ink is used, in case the highlights section is recorded, the granular feeling of the record dot in the highlights section is reduced. Moreover, the expression of more smooth gradation is attained because the number of gradation increases, and a high-definition image can be obtained.

[0096] In addition, when recording a dot pattern as shown in above-mentioned drawing 30 or drawing 31 using the recording head concerning this invention as shown in drawing 1, by one horizontal scanning (one pass) of a recording head, the dot pattern shown in drawing 30 or drawing 31 cannot be recorded on the relation of dot arrangement of a record dot and a clear ink dot. Therefore, when recording a dot pattern as shown in drawing 30 or drawing 31, it records using a multi-pass method. However, it cannot be overemphasized that the dot pattern in which an usable dot pattern is not restricted to the above-mentioned drawing 30 and drawing 31 in this operation gestalt, but dot arrangement of a record dot and a clear ink dot differs from drawing 30 and drawing 31 may be used. In that case, one-pass record is attained by using the dot pattern by which the dot has been arranged so that one-pass record may be possible.

[0097] Moreover, the example of other dot patterns is shown in drawing 32 and drawing 33. Drawing 32 shows the dot pattern for 9 gradation value, and shows the case where the ratio of a record ink dot and a clear ink dot is always 1:1. Moreover, drawing 33 shows the dot pattern for 18 gradation value, and shows the case where the ratio of a record ink dot and a clear ink dot changes like 1:1, 1:2, 2:3, and 3:4 —. Thus, it is better to carry out like [although regularity is always sufficient as the ratio of a record dot and clear ink like drawing 32 and you may make it change like drawing 33 / to express more gradation] drawing 33. In addition, it is the dot pattern which the both sides which show this drawing 32 and drawing 33 can one-pass record. [0098] Thus, according to this operation gestalt, it is possible to make the number of gradation increase without reducing output resolution without changing the magnitude of the dot matrix corresponding to 1 pixel, and the pattern field excellent in gradation nature can be formed. Moreover, since it is made to mix with record ink and clear ink, the concentration difference between gradation decreases, if the evil in the case of using shade ink, i.e., the difference of the concentration between shade ink, is serious, the switch parts (bond part) of light ink and dark ink in a record image are conspicuous, and the evil in which image grace is reduced does not arise. [0099] With this above-mentioned operation gestalt, the 1st or 2nd recording mode is set up according to whether it is an alphabetic character field or it is a pattern field. When it was an alphabetic character field, the 1st recording mode was specifically set up, and when it is a pattern field, the 2nd recording mode is set up. Thus, the reason to set up is that there is generally no gradation nature in an alphabetic character field, and there is gradation nature in a pattern field as mentioned above. That is, if this 2nd operation gestalt is seen in another view, according to the existence of gradation nature, it can also be said that the recording mode is set

up. Therefore, this 2nd operation gestalt is good also as setting up a recording mode according to whether that field has gradation nature paying attention to gradation nature. In this case, paying attention to the gradation level of image data, the field where gradation level is fixed is recorded by the 1st recording mode, and the field which has change in gradation nature level is recorded by the 2nd recording mode. Specifically, the gradation level for every pixel in the multiple-value image data of inputted RGB is detected first. Next, it judges whether the pixel of the same gradation level is continuing in the direction of X-Y more than the predetermined number. And when judged with continuing, the field is judged to be a non-gradation field, and in order to record only in record ink, the 1st recording mode is set up. On the other hand, when judged with not continuing, the field is judged to be a gradation field, and in order to record on the both sides of record ink and clear ink, the 2nd recording mode is set up. By doing in this way, setting out of the recording mode according to the existence of gradation nature is attained. In addition, as an image without gradation nature, the image of an alphabetic character, a graph, a table, and a poster tone etc. is mentioned, for example.

[0100] In addition, as mentioned above although [the 2nd operation gestalt] each processing of detection of an alphabetic character field, setting out of a recording mode, etc. is performed by the host computer 1710 side, said each processing may be performed by the printer side by storing the program for performing said each processing in the memory section of a printer. Moreover, although MPU1700 is made to process by the program which stored this the processing of each in ROM1701 in drawing 17 by software, the circuit of the dedication for performing this processing of each is established in a printer side, and you may make it hardware constitute from the 2nd operation gestalt.

[0101] Moreover, in the flow chart of drawing 22 concerning the 2nd operation gestalt, according to the inputted image data (are they an alphabetic character field or a pattern field?), although the host computer has set up the 1st recording mode and 2nd recording mode automatically, it is not limited to this. That is, a user may perform setting out of the 1st recording mode and the 2nd recording mode. In this case, a switch and a panel are prepared in an ink jet recording apparatus, and it is possible that this sets up the mode. Or a user may set up by the printer driver processed within a host computer, or you may carry out. Thus, when a user sets up, there is an advantage that an image can be outputted according to a user's application or liking. On the other hand, when a host computer sets up automatically, since a user has to do nothing, he has the advantage that actuation of a user is easy.

[0102] In addition, although the case where the image with which the alphabetic character field and the pattern field were intermingled above was recorded was shown, naturally this operation gestalt can be applied, without being limited to this, also when recording the image of only an alphabetic character, and the image of only a pattern.

[0103] According to this operation gestalt, it faces recording an image using the high density head by which the nozzle for record ink regurgitation and the nozzle for clear ink regurgitation have been arranged by turns as mentioned above. It is recording the ungrammatical sentence character field (pattern field) where gradation nature's is demanded on the both sides of record ink and clear ink, and recording the alphabetic character field where gradation nature's is not demanded only in record ink. The clear alphabetic character which can form the pattern field excellent in gradation nature, and shows fixed gradation level can be formed. Therefore, the high-definition image which has the pattern field which was excellent in using this operation gestalt at gradation nature even when the image with which the pattern field and the alphabetic character field were intermingled was recorded, and a clear alphabetic character becomes recordable.

[0104] The 1st operation gestalt and the 2nd operation gestalt which carried out [operation gestalt of ** 3rd] **** are performing one-pass record by setting up either the 1st recording mode or the 2nd recording mode. According to the operation gestalt of the above 1st, and the 2nd operation gestalt, since a sufficiently high-definition image can be formed in a short time, it thinks [that one-pass record is enough in many cases and]. However, even if chart lasting time becomes long depending on a user's application and image which should be liked or recorded, it may be more desirable to form a more nearly high-definition image. In such a case, recording by

the multi-pass method is desirable. Namely, it records by setting up the 3rd recording mode and 4th recording mode. In addition, if the 3rd recording mode is set up, the predetermined field will be only record ink, and will be recorded by the scan of multiple times, and if the 4th recording mode is set up, the predetermined field will be the both sides of record ink and clear ink, and will be recorded by the scan of multiple times. A user may set up setting out of this 3rd recording mode and the 4th recording mode by the switch or the panel for having prepared for the ink jet recording apparatus, and may set it up by the printer driver processed within a host computer. Moreover, according to image data, a host computer or an ink jet recording device may set up automatically like the 1st operation gestalt or the 2nd operation gestalt. In this case, you may make it always set up either the 3rd recording mode or the 4th recording mode, and may make it set up any one of the 1st, 2nd, 3rd, or 4th recording mode according to image data.

[0105] According to this operation gestalt, chart lasting time will start for a long time rather than the 1st operation gestalt or the 2nd operation gestalt as mentioned above by using the 3rd recording mode or 4th recording mode which records by the multi-pass method, but [instead] formation of an image more nearly high-definition than the 1st operation gestalt and the 2nd operation gestalt is attained.

[0106] [The 4th operation gestalt], next the 4th operation gestalt of this invention are explained. With this 4th operation gestalt, according to a user's application, liking, etc., a user chooses himself the mode of the class of image, the images (document, photograph, mixture image, etc.) grace, chart lasting time (high definition mode and fast mode), etc. which it is going to record, and it is characterized by setting up the 1st, 2nd, 3rd, or 4th recording mode according to that selection result.

[0107] Drawing 34 is a flow chart which shows the 4th operation gestalt, and explains this operation gestalt using this drawing 34. In addition, the case where the class of image is three kinds such as a document, a photograph, and a mixture image (image with which the alphabetic character, the illustration, the table, the photograph, etc. were intermingled) is mentioned as an example, and is explained here.

[0108] First, in step S1, a user chooses the image mode which showed the class of images, such as a document, a photograph, and a mixture image, according to the image which should be recorded. When a document is chosen, it progresses to step S2. At step S2, it chooses whether it records in the high definition mode which thought image grace as important, or it records by the fast mode which thought the recording rate as important. When high definition mode is chosen, it progresses to step S3, and the 3rd recording mode is set up. That is, it records by the multi-pass method only using record ink to record a high-definition document. On the other hand, when fast mode is chosen, it progresses to step S4, and the 1st recording mode is set up. That is, it records by the one pass only using record ink to record a document for a short time.

[0109] Moreover, in step S1, when a photograph is chosen, it progresses to step S5. At step S5, it chooses whether it records in the high definition mode which thought image grace as important, or it records by the fast mode which thought the recording rate as important. When high definition mode is chosen, it progresses to step S6, and the 4th recording mode is set up. That is, it records by the multi-pass method using the both sides of record ink and clear ink to record a high-definition photograph. On the other hand, when fast mode is chosen, it progresses to step S7, and the 2nd recording mode is set up. That is, it records by the one pass using the both sides of record ink and clear ink to record a photograph for a short time.

[0110] Moreover, in step S1, when a mixture image is chosen, it progresses to step S8. At step S8, it chooses whether it records in the high definition mode which thought image grace as important, or it records by the fast mode which thought the recording rate as important. When high definition mode is chosen, it progresses to step S9, and it chooses whether the grace of the alphabetic character section in a mixture image is thought as important by step S9, or the grace of the non-alphabetic character section is thought as important. When thinking the alphabetic character section as important, it progresses to step S10, and the 3rd recording mode is set up. That is, when recording the mixture image with which the alphabetic character section and the non-alphabetic character section are intermingled by high definition and thinking especially the grace of the alphabetic character section as important, it records by the multi-pass method only

using record ink. Moreover, when thinking the non-alphabetic character section as important, it progresses to step S11, and the 4th recording mode is set up. That is, especially when recording the mixture image with which the alphabetic character section and the non-alphabetic character section are intermingled by high definition, and thinking the grace of the non-alphabetic character section as important, it records by the multi-pass method using the both sides of record ink and clear ink.

[0111] On the other hand, when fast mode is chosen at step S8, it progresses to step S12, and it chooses whether the grace of the alphabetic character section in a mixture image is thought as important at step S12, or the grace of the non-alphabetic character section is thought as important. When thinking the alphabetic character section as important, it progresses to step S13, and the 1st recording mode is set up. That is, when recording the mixture image with which the alphabetic character section and the non-alphabetic character section are intermingled for a short time and thinking especially the grace of the alphabetic character section as important, it records by the one pass only using record ink. Moreover, when thinking the non-alphabetic character section as important, it progresses to step S14, and the 2nd recording mode is set up. That is, especially when recording the mixture image with which the alphabetic character section and the non-alphabetic character section are intermingled for a short time, and thinking the grace of the non-alphabetic character section as important, it records by the one pass using the both sides of record ink and clear ink.

[0112] After setting up a recording mode in the above-mentioned step S3, S4, and each of S6, S7, S10, S11, S13, and S14, it progresses to step S15, and image data is created. And record based on the image data is performed by ink JETO storage.

[0113] Since a user can choose this operation gestalt *****; image grace, chart lasting time, etc. as mentioned above, image recording which suited the demand of a user can be performed. [0114] [The 5th operation gestalt], next the 5th operation gestalt of this invention are explained. With this 5th operation gestalt, discharge quantity from the nozzle for record ink regurgitation is characterized by being fewer than the discharge quantity from the nozzle for clear ink regurgitation. Drawing 48 - drawing 50 are used for below, and this operation gestalt is explained. In addition, drawing 48 is the outline block diagram of a recording head applicable with this operation gestalt, (a) is the recording head (linear array mold recording head) by which the nozzle for clear ink regurgitation with a large path was arranged linearly relatively [nozzle / with a small path / for record ink regurgitation] relatively, and (b) is the recording head (staggered arrangement mold recording head) by which these nozzles were arranged alternately. Drawing 49 is drawing showing the configuration of the recording head unit 9 possessing two or more recording heads 90 shown in drawing 48, (a) shows the case where the linear array mold recording head 90 shown by drawing 48 is arranged to a horizontal single tier, and (b) shows the case where the linear array mold recording head 90 shown by drawing 48 is arranged to a vertical single tier. Drawing 50 is drawing showing the recording mode ((c) and (d)) using the both sides of the recording mode ((a) and (b)) which uses only record ink, record ink, and clear ink. In detail, it is shown that (a) drives only the small nozzle for record ink regurgitation of a path relatively, and (b) shows the record ink dot which reached the target on recorded media. Moreover, it is shown that both (c) drives the large nozzle for clear ink regurgitation of a path relatively [nozzle / with a small path / for record ink regurgitation] relatively, and (d) shows signs that the record ink dot and clear ink dot which reached the target on recorded media contact, and the dot of the both sides mixes.

[0115] Discharge quantity from the nozzle for record ink regurgitation is relatively lessened rather than the discharge quantity from the nozzle for clear ink regurgitation with constituting from this operation gestalt so that the diameter of a nozzle of the nozzle for record ink regurgitation may become small relatively rather than the diameter of a nozzle of the nozzle for clear ink regurgitation, as shown in drawing 48. If the nozzle radius of the nozzle for clear ink regurgitation is set to r , specifically, it constitutes so that the nozzle radius R of the nozzle for record ink regurgitation may be set to $R < 0.9r$. Thus, compared with the nozzle radius r of the nozzle for clear ink regurgitation, the nozzle radius R of the nozzle for record ink regurgitation is small constituted for the variation in the diameter of a dot occurring about several% 10% or more.

(The volume of the ink droplet breathed out from the same nozzle has the variation under the effect of fluctuation of regurgitation power or surface tension, the ink refill by whether it breathed out from the nozzle just before, etc., and the diameter of a dot produces several% of variation further by the volume of an ink droplet and the satellite drop separated in the air, physical relationship, the difference in the diffusion condition of the ink droplet according to the heterogeneity on the front face of the detail paper further, etc.). That is, within the limits of variation ($R > 0.9r$), since the effectiveness by having made the nozzle for record ink regurgitation small relatively is hardly accepted, the magnitude of the diameter of a nozzle is changed more than the range of the variation in the diameter of a dot. therefore, ** set to $R < 0.9r$ with this operation gestalt — it constitutes like. On the other hand, the minimum of R is constituted so that it may become $0.7r < R$. It is because a clear ink dot will become large too much compared with a record ink dot, consequently considering as $0.7r < R$ will stop being able to perform an exact gradation expression easily, if the diameter of a nozzle of the nozzle for record ink regurgitation is made smaller than the diameter of a nozzle of the nozzle for clear ink regurgitation more than this. Since it is such, it constitutes so that $0.7r < R < 0.9r$ may be filled with this operation gestalt, when the nozzle radius of r and the nozzle for record ink regurgitation is set to R for the nozzle radius of the nozzle for clear ink regurgitation.

[0116] Moreover, although both discharge quantity is changed by changing relatively size **** of the diameter of a nozzle of the nozzle for record ink regurgitation, and the nozzle for clear ink regurgitation above, this operation gestalt is good also as a configuration which only changes both discharge quantity, without not being restricted to this but changing the diameter of a nozzle, as an approach of changing discharge quantity, the pulse width, driver voltage, etc. of the driving pulse impressed to a regurgitation nozzle are changed, for example — making — slack — things are realized. And he is trying for the discharge quantity per drop of record ink to become less than the discharge quantity per drop of clear ink with this operation gestalt. If discharge quantity of clear ink is set to $V1$, specifically, it will control so that the discharge quantity $V2$ of record ink is set to $V2 < 0.8V1$. As it mentioned above being referred to as $V2 < 0.8V1$, the variation in the diameter of a dot is for being certain about several%. On the other hand, the minimum of $V2$ is controlled to be set to $0.5V1 < V2$. It is because a clear ink dot will become large too much compared with a record ink dot, consequently being referred to as $0.5V1 < V2$ will stop being able to perform an exact gradation expression easily, if discharge quantity of record ink is made fewer than the discharge quantity of clear ink more than this. Since it is such, it is controlling to fill $0.5V1 < V2 < 0.8V1$ with this operation gestalt, when discharge quantity of $V1$ and record ink is set to $V2$ for the discharge quantity of clear ink.

[0117] In addition, the sum of the discharge quantity per drop from the nozzle for record ink regurgitation in this operation gestalt, and the discharge quantity per drop from the nozzle for clear ink regurgitation, the sum of the discharge quantity per drop from the nozzle for record ink regurgitation in the 1st operation gestalt, and the discharge quantity per drop from the nozzle for clear ink regurgitation — abbreviation — so that it may become the same. The diameter of a nozzle of the nozzle for record ink regurgitation and the diameter of a nozzle of the nozzle for clear ink regurgitation in this operation gestalt are set up. For example, with this operation gestalt, if both discharge quantity of the record ink in the 1st operation gestalt and discharge quantity of clear ink are set to X , the diameter of a nozzle of the nozzle for record ink regurgitation and the diameter of a nozzle of the nozzle for clear ink regurgitation are set up so that the discharge quantity of $0.8X$ and clear ink may serve as [the discharge quantity of record ink] 1.2X.

[0118] In order that record ink may globule-size according to these above operation gestalten, it becomes possible to perform higher definition image recording compared with the 1st operation gestalt in the field which records only in record ink. Moreover, since it is made to mix with record ink and clear ink when recording a solid field by the one pass, concentration can be raised rather than it records only in record ink.

[0119] [The 6th operation gestalt], next the 6th operation gestalt of this invention are explained. With this 6th operation gestalt, discharge quantity from the nozzle for clear ink regurgitation is characterized by being fewer than the discharge quantity from the nozzle for record ink

regurgitation. Drawing 51 – drawing 53 are used for below, and this operation gestalt is explained. In addition, drawing 51 is the outline block diagram of a recording head applicable with this operation gestalt. (a) is the recording head (linear array mold recording head) by which the nozzle for record ink regurgitation with a large path was arranged linearly relatively [nozzle / with a small path / for clear ink regurgitation] relatively, and (b) is the recording head (staggered arrangement mold recording head) by which these nozzles were arranged alternately. Drawing 52 is drawing showing the configuration of the recording head unit 9 possessing two or more recording heads 90 shown in drawing 51. (a) shows the case where the linear array mold recording head 90 shown by drawing 51 is arranged to a horizontal single tier, and (b) shows the case where the linear array mold recording head 90 shown by drawing 51 is arranged to a vertical single tier. Drawing 53 is drawing showing the recording mode ((c) and (d)) using the both sides of the recording mode ((a) and (b)) which uses only record ink, record ink, and clear ink. In detail, it is shown that (a) drives only the large nozzle for record ink regurgitation of a path relatively, and (b) shows the record ink dot which reached the target on recorded media. Moreover, it is shown that both (c) drives the large nozzle for record ink regurgitation of a path relatively [nozzle / with a small path / for clear ink regurgitation] relatively, and (d) shows signs that the record ink dot and clear ink dot which reached the target on recorded media contact, and the dot of the both sides mixes.

[0120] Discharge quantity from the nozzle for clear ink regurgitation is relatively lessened rather than the discharge quantity from the nozzle for record ink regurgitation with constituting from this operation gestalt so that the diameter of a nozzle of the nozzle for clear ink regurgitation may become small relatively rather than the diameter of a nozzle of the nozzle for record ink regurgitation, as shown in drawing 51. If the nozzle radius of the nozzle for record ink regurgitation is set to s , specifically, it constitutes so that the nozzle radius S of the nozzle for clear ink regurgitation may be set to $S < 0.9s$. Thus, compared with the nozzle radius s of the nozzle for record ink regurgitation, the nozzle radius S of the nozzle for clear ink regurgitation is small constituted for the variation in the diameter of a dot occurring about several 10% or more. That is, within the limits of variation ($S > 0.9s$), since the effectiveness by having made the nozzle for clear ink regurgitation small relatively is hardly accepted, the magnitude of the diameter of a nozzle is changed more than the range of the variation in the diameter of a dot. Therefore, ** set to $S < 0.9s$ with this operation gestalt -- it constitutes like. On the other hand, the minimum of S is constituted so that it may become $0.7 \text{ second} < S$. It is because a clear ink dot will become small too much compared with a record ink dot, consequently a clear dot, in addition ***** will change to record ink and considering as $0.7 \text{ second} < S$ will stop being able to perform ***** and an exact gradation expression easily, if the diameter of a nozzle of the nozzle for clear ink regurgitation is made smaller than the diameter of a nozzle of the nozzle for record ink regurgitation more than this. Since it is such, it constitutes so that $0.7 \text{ second} < S < 0.9s$ may be filled with this operation gestalt, when the nozzle radius of s and the nozzle for record ink regurgitation is set to S for the nozzle radius of the nozzle for clear ink regurgitation.

[0121] Moreover, although both discharge quantity is changed by changing relatively size ***** of the diameter of a nozzle of the nozzle for record ink regurgitation, and the nozzle for clear ink regurgitation above, this operation gestalt is good also as a configuration which only changes both discharge quantity, without not being restricted to this but changing the diameter of a nozzle, as an approach of changing discharge quantity, the pulse width, driver voltage, etc. of the driving pulse impressed to a regurgitation nozzle are changed, for example -- making -- slack -- things are realized. And he is trying for the discharge quantity per drop of clear ink to become less than the discharge quantity per drop of record ink with this operation gestalt. If discharge quantity of record ink is set to $N1$, specifically, it will control so that the discharge quantity $N2$ of clear ink is set to $1.2 < 0.8Ns$ of N . The variation in the diameter of a dot of being referred to as $1.2 < 0.8Ns$ of N is for being certain about several%. On the other hand, the minimum of $N2$ is controlled to be set to $0.5-N1 < N2$. It is because a clear ink dot will become small too much compared with a record ink dot, consequently a clear dot, in addition ***** will change to record ink and being referred to as $0.5-N1 < N2$ will stop being able to perform ***** and an exact gradation expression easily, if discharge quantity of clear ink is made fewer than the

discharge quantity of record ink more than this. Since it is such, it is controlling to fill 1 with this operation gestalt $2 < 0.8Ns$ of $0.5-N1 < N$, when discharge quantity of $N1$ and record ink is set to $N2$ for the discharge quantity of clear ink.

[0122] In addition, the sum of the discharge quantity per drop from the nozzle for record ink regurgitation in this operation gestalt, and the discharge quantity per drop from the nozzle for clear ink regurgitation, the sum of the discharge quantity per drop from the nozzle for record ink regurgitation in the 1st operation gestalt, and the discharge quantity per drop from the nozzle for clear ink regurgitation -- abbreviation -- so that it may become the same. The diameter of a nozzle of the nozzle for record ink regurgitation and the diameter of a nozzle of the nozzle for clear ink regurgitation in this operation gestalt are set up. For example, with this operation gestalt, if both discharge quantity of the record ink in the 1st operation gestalt and discharge quantity of clear ink are set to X , the diameter of a nozzle of the nozzle for record ink regurgitation and the diameter of a nozzle of the nozzle for clear ink regurgitation are set up so that the discharge quantity of $0.8X$ and record ink may serve as [the discharge quantity of clear ink] $1.2X$.

[0123] Since the discharge quantity of record ink increases according to these above operation gestalten, it becomes possible to perform high concentration image recording compared with the 1st operation gestalt.

[0124] [The 7th operation gestalt], next the 7th operation gestalt of this invention are explained. With this 7th operation gestalt, in order to reduce the concentration nonuniformity (bond stripe) generated in the knot part between scans, it is characterized by carrying out the regurgitation of the clear ink to a knot part or its periphery. Hereafter, this operation gestalt is explained using drawing 54 – drawing 59.

[0125] First, the conventional example is explained before explaining this operation gestalt.

Drawing 54 shows the case where an image is recorded by two scans using the conventional record approach. (a) shows signs that the record dot reached the normal location, in the bond part between scans, does not generate image defects, such as stripe nonuniformity, but has become the uniform image which does not have concentration nonuniformity on the whole.

Although it is ideal to make a dot reach a normal location as shown in this (a), since regurgitation ***** arises or paper feed precision is inadequate actually, the impact location of ink varies.

Signs that the image defect generated (b) – (c) of drawing 54 in the bond part for the variation in an impact location are shown, the dot which adjoins in the bond part by the m -th scan and the $m+1$ st scans in (b) -- beyond the need -- lapping -- the bond part -- it is and the black stripe has occurred, the bond part according to the m -th scan and the $m+1$ st scans at (c) on the other hand -- setting -- the distance between contiguity dots -- beyond the need -- opening -- the bond part -- it is and the white stripe has occurred. Thus, by the conventional record approach, there was a case where a black stripe and a white stripe occurred in the bond part during a scan.

[0126] So, with this operation gestalt, as shown in drawing 55, clear ink is breathed out in the bond part between scans. (A) of drawing 55 does not have generating of ink ***** etc., and the case where ink reaches a normal location (target position) is shown. He is trying for the clear dot breathed out from the $n+1$ st clear ink nozzles in the m -th scan and the clear dots breathed out from the 1st clear ink nozzle in the $m+1$ st scans to overlap mutually here. (a-3) of (A) is the image recorded from record ink and clear ink reaching a target position in this way. In this case, since record ink and clear ink have reached the target impact location, image defects, such as stripe nonuniformity, do not arise.

[0127] In the bond parts of the m -th scan and the $m+1$ st scans, the record ink and clear ink which were breathed out in the m -th scan, the record ink breathed out in the $m+1$ st scans, and clear ink gather mutually, and (B) of drawing 55 shows the case where record ink and clear ink overlap in this bond part beyond the need. Here, the clear ink dot breathed out from the 1st clear ink nozzle in the $m+1$ st scans also overlaps the record ink dot it not only laps with the clear dot breathed out from the $n+1$ st clear ink nozzles in the m -th scan, but breathed out from the n -th record ink nozzle in the m -th scan. (b-3) of (B) is the image with which record ink and clear ink were recorded from overlapping beyond the need and reaching the target in a bond part

in this way. Thus, although the concentration in this part became high too much and concentration nonuniformity, such as a black stripe, was generated in the former when the record ink dots which reached the target in the m-th scan and the m+1st scans approached too much. Since record ink is made to spread in clear ink and the concentration of a knot part is reduced by making clear ink reach the target between record ink dots with this operation gestalt as shown in (B) of drawing 55 Generating of the concentration nonuniformity by record ink dots overlapping beyond the need can be controlled.

[0126] (C) of drawing 55 shows the case where the clear ink breathed out in the m-th scan and the clear ink breathed out in the m+1st scans do not overlap, in the bond parts of the m-th scan and the m+1st scans. Specifically, the clear ink dot breathed out from the 1st clear ink nozzle in the m+1st scans and the clear dot breathed out from the n+1st clear ink nozzles in the m-th scan have not lapped. Moreover, the distance of the record ink dot breathed out from the 1st record ink nozzle in the m+1st scans and the record dot breathed out from the n-th record ink nozzle in the m-th scan will also become longer than a regular distance, and record ink dots will leave it. In such a case, although concentration nonuniformity, such as a white stripe, was generated in the former when a clearance was generated between dots in this part. Since record ink is made to spread in clear ink and amplification of the diameter of a dot of a record ink dot is reduced by making clear ink reach the target between record ink dots with this operation gestalt as shown in (C) of drawing 55 Though record ink dots are separated, it is hard to produce a clearance between dots, and generating of concentration nonuniformity can be controlled.

[0129] Next, the case where the one-pass record is performed using the record approach of this operation gestalt, and two pass record are performed is explained. Drawing 56 is drawing for explaining the one-pass record which records an image by carrying out the scan of the recording head only once to fields other than the bond part by each scan. Drawing 57 is drawing for explaining the two pass record which records an image by carrying out the relative scan of the record nozzle twice to fields other than the bond part by each scan. As shown in drawing 56, whenever a recording head carries out horizontal scanning once in one-pass record, a record medium carries out vertical scanning only of the 1st amount in the direction which carries out an abbreviation rectangular cross with a main scanning direction. The 1st amount is the same as the distance of the center to center of each delivery of the clear ink nozzle (the 1st clear ink nozzle and the n+1st clear ink nozzles) located in the ends of a recording head. That is, whenever a recording head carries out horizontal scanning once, a record medium carries out vertical scanning only of the amount of d1 in drawing. Here, the amount of vertical scanning is set to d1 for making it the field which the n+1st clear ink nozzles scanned in horizontal scanning before one, and the field which the 1st clear ink nozzle scans in the next horizontal scanning become the same. In other words, the amount of vertical scanning is set as ** which makes the same field scan in horizontal scanning which gets mixed up the clear ink nozzle of one edge of a recording head, and the clear ink nozzle of the other-end section like d1 in drawing. Thus, by setting the amount of vertical scanning to d1, clear ink can be made to be able to overlap in a bond part, and reduction of the concentration nonuniformity of a calm part can be aimed at in one-pass record. Moreover, after it carries out vertical scanning only of the 2nd amount (d2) and a head carries out horizontal scanning again after that, only the 3rd amount (d1+d2) carries out vertical scanning of the record medium as shown in drawing 57, after a recording head carries out horizontal scanning once in two pass record shortly. Image recording is performed by repeating this. In addition, d2 is an adjoining center-to-center-dimension of each delivery of an ink nozzle and a clear ink nozzle. That is, vertical scanning of the record medium is carried out by one nozzle here. By setting up the amount of vertical scanning as mentioned above, a record ink nozzle and a clear ink nozzle will be scanned by a unit of 1 time, consequently fields other than a bond part can raise the whole image concentration now. Moreover, since record ink and clear ink can be made to overlap also in a bond part, it becomes possible to aim at reduction of concentration nonuniformity in a bond part. In addition, in the above, although vertical scanning is carried out by one nozzle, number nozzle part vertical scanning may be restricted and carried out to this. Moreover, with this operation gestalt, two or more pass records, such as not the thing limited to one-pass record and two

pass record but three pass and 4 pass --, can also be performed.

[0130] According to this operation gestalt, it becomes possible by controlling to carry out the regurgitation of the clear ink to the bond part by each scan, or its circumference part to reduce the concentration nonuniformity which is easy to generate in the bond section as mentioned above.

[0131] With the [operation gestalt of ** 8th] book operation gestalt, it is characterized by only for record ink performing image recording, in recording the edge section of the image which needs high resolution, and performing image recording on the both sides of record ink and clear ink, when resolution records the non-edge section or the solid field of an unnecessary image.

[0132] First, the 1st recording mode only using record ink is explained using drawing 13. This 1st recording mode is applied when recording the edge section of the image with which the high resolution of an alphabetic character, a thin line, etc. is demanded. This drives only a record ink regurgitation nozzle and a clear ink regurgitation nozzle is realized by making it not drive. By carrying out like this, as shown in drawing 13, only a record dot is formed on recorded media. Since the probability, as for the image which consists of only this record dot, for contiguity dots to lap is low, there are little the blot and the effect of getting twisted of a dot, and since it is also high resolution, it can be said that it is the high image of grace. Moreover, since it exists after the dot has become independent, and an edge is emphasized, it is effective.

[0133] Next, the 2nd recording mode using the both sides of record ink and clear ink is explained using drawing 10 and drawing 14. This 2nd recording mode is effective when recording the non-edge section which does not have the solid field or gradation nature of an image with unnecessary resolution especially (gradation level is fixed). When recording a solid field and the non-edge section by the 2nd recording mode of the above, it realizes by drawing 10 (a) and all the nozzles in the head of drawing 14 (a). And in order are liquefied and to make it mix with the record ink and clear ink which are breathed out, it is desirable to carry out the regurgitation of record ink and the clear ink by the same horizontal scanning of a recording head. Thus, by it being liquefied and making it mix with record ink and clear ink on recorded media, a record ink dot can extend in clear ink, and the coat area of a record ink dot becomes large. By carrying out like this, it becomes possible to record a solid field and the non-edge section for a short time.

[0134] Here, when recording a solid field and the non-edge section, why it is effective making it mix with record ink and clear ink is explained. First, it is because chart lasting time can be shortened [1st]. As mentioned above, since adjoining record ink dots do not overlap, one scan of a recording head cannot cover the predetermined field in recorded media with this operation gestalt thoroughly at a record ink dot. That is, in one horizontal scanning (one pass), between record ink dots, a clearance is vacant and neither a solid field nor the non-edge section can be recorded. Temporarily, if it is going to record a solid field and the non-edge section only by the record dot using the head of this operation gestalt, it must record by the multi-pass method, chart lasting time will be long, and it will keep. Then, it enables it to record a solid field and the non-edge section by one horizontal scanning of a recording head by making it mix with record ink and clear ink, and enlarging coat area of record ink. It is because record concentration can be made high the 2nd. When it is going to record a solid field and the non-edge section only by the record ink dot using the head of this operation gestalt, in one scan of a recording head, between contiguity dots, a clearance will be made and record concentration will become low. Then, lifting of record concentration is in drawing by making it mix with record ink and clear ink, and enlarging coat area of record ink. As mentioned above, in order to record the solid field and the non-edge section which have sufficient record concentration for a short time, it is made to mix with record ink and clear ink with this operation gestalt.

[0135] In addition, although the recording rate is thought as important and one-pass record is enabled especially in the 1st recording mode of the above, since contiguity dots will not touch if it records by the one pass, a clearance is made between dots, and the grace of an image may fall by the clearance and it may be visible. Then, what is necessary is just to record on the 1st recording mode using the recording method which applied the multi-pass method to record an image with more high grace. The image with which only record ink is breathed out by the one-

pass eye, and a contiguity dot does not touch is formed like the 1st recording mode concrete first. Next, after conveying recorded media in the direction of vertical scanning, only record ink is breathed out so that between the dots recorded by the one-pass eye in the two pass eye may be complemented. It becomes possible by doing in this way to record the image of high resolution without a clearance between dots, and high definition-ization can be attained rather than it records by the 1st recording mode. Let the recording method which applied this multi-pass method be the 3rd recording mode. In addition, if this 3rd recording mode is applied, while-izing can be carried out [high definition] rather than the 1st recording mode, lowering of a recording rate will be caused. For example, if a number of passes is made into 2 times, chart lasting time will take 3 or more times, if it is made into more than twice and 3 times. What is necessary is just to use properly by the case where the case where a recording rate is thought as important in consideration of this, and record grace are thought as important, since there is an advantage in the 1st recording mode and 3rd recording mode as mentioned above.

respectively. Moreover, let the recording method which applied the multi-pass method to the 2nd recording mode be the 4th recording mode. The 4th record MORT is used with the 3rd record MORT. It is because both modes are multi-passes and can double a number of passes by this. In addition, even if it is a time of recording by the 4th recording mode, the record ink and clear ink which are breathed out from a contiguity nozzle are breathed out by the same horizontal scanning of a recording head.

[0136] Thus, it is possible to record with this operation gestalt by the 1st recording mode, the 2nd recording mode, the 3rd recording mode, and the 4th recording mode. And according to whether the edge section of an image is recorded, or the non-edge section is recorded, it is determined whether to set up the 1st recording mode (or the 3rd mode) only using record ink or set up the 2nd recording mode (or the 4th mode) using the both sides of record ink and clear ink. moreover, an one pass -- record -- carrying out (that is, the 1st recording mode and 2nd mode being used) -- multi-pass record -- carrying out (that is, the 3rd recording mode and 4th mode being used) -- determining according to a user's selection is desirable.

[0137] With the 8th operation gestalt concerning this invention, it is characterized by carrying out using the 2nd recording mode to the non-edge section of an image with unnecessary resolution using the 1st recording mode to the edge section as which resolution is required. This is explained using drawing 58 - drawing 63 .

[0138] First, the control configuration for performing control of each part of the ink jet recording apparatus concerning the 8th operation gestalt is explained with reference to the block diagram shown in drawing 58 . In this drawing showing a control circuit, Program ROM and 2013 which store the control program with which MPU performs the interface whose 2010 inputs a record signal, and 2011, and MPU11 performs 2012 are RAM of the dynamic mold which saves various data (record data supplied to the above-mentioned record signal or a head), and it can memorize the number of printing dots, the turnover rate of an ink recording head, etc. 2014 is a gate array which performs supply control of the record data to a recording head 90, and also performs interface 2010 and data transfer control between MPU2011 and RAM2013. 7004 is an edge section detection means and detects the edge section in an image. A carrier motor for 2020 to convey a recording head 90 and 2019 are the conveyance motors for record form conveyance. The head driver to which 2015 drives a head, and 2016 and 2017 are Motor Driver which drives the conveyance motor 2019 and the carrier motor 2020, respectively.

[0139] Drawing 59 is the circuit diagram showing the detail of each part of drawing 58 . A gate array 2014 has the data latch 2141, the segment (SEG) shift register 2142, a multiplexer (MPX) 2143, the common (COM) timing generating circuit 2144, and a decoder 2145. The diode-matrix configuration is taken, an actuation current flows at the heater for regurgitation (from H1 to H64) the common signal COM and whose segment signal SEG corresponded, ink is heated by this and a recording head 90 is breathed out.

[0140] The above-mentioned decoder 2145 decodes the timing which the above-mentioned common timing generating circuit 2144 generated, and chooses any one of the common signals 1-COMs 8. The data latch 2141 latches the record data by which reading appearance was carried out from RAM2013 by 8 bitwises, and a multiplexer 2143 outputs this record data as

segment signals 1-SEG 8 according to the segment shift register 2142, the output from a multiplexer 2143 -- 1 bitwises and 2 bitwises -- or 8 bits of all etc. can be variously changed according to the content of the shift register 2142.

[0141] If actuation of the above-mentioned control configuration is explained, and a record signal goes into an interface 2010, a record signal will be changed into the record data for a print between a gate array 2014 and MPU2011. And while Motor Driver 2016 and 2017 drives, a recording head drives according to the record data sent to the head driver 2015, and printing is performed.

[0142] Drawing 60 shows the block diagram explaining the record data flow inside a recording apparatus. The record data sent from the host computer are stored in the receive buffer inside a recording apparatus through an interface. The receive buffer has the capacity of several k - 10 K bytes of number. After command analysis is performed to the record data stored in the receive buffer, it is sent to a text buffer. In a text buffer, record data are held as an intermediate form for a party, and processing to which the address of the printing location of each alphabetic character, the class of qualification, magnitude, an alphabetic character (code), and a font etc. is added is performed. The capacity of a text buffer differs by every model, and if they is a serial printer and they is the capacity for several lines, and a page printer, they has the capacity for 1 page. Furthermore, it stores, after it developed the record data stored in the text buffer and having been made binary by the print buffer, and delivery and record are performed to a recording head in a signal as record data. There are some which develop the record data stored in the receive buffer to command analysis and coincidence, and are written in a print buffer without having a text buffer depending on the class of recording apparatus.

[0143] Next, the edge section detection means 7004 is explained. With this operation gestalt, when a record pixel exists in less than 2 pixels of perimeters of a non-recording pixel, it is considering as the specification detected as the edge section.

[0144] In a recording apparatus, the record data for every color are developed to the bit drawing data of 1 of whether it records in advance of record, or not to carry out, and 0 (below, the this memory developed is called a print buffer).

[0145] Here, in order to detect whether a record pixel exists in 2 pixels of perimeters of a non-recording pixel, the data which reversed the data of the print buffer for record to the buffer 1 of operating are developed, and a non-recording pixel buffer is created. Next, the pixel buffer in which developed the data which prepared the buffer 2 of operating and took the OR for 2 bits (the direction of X) of right and left for the data of a buffer 1 to this buffer 2, and non-recording pixel data carried out the board in the direction of X by 2 pixels is created. Furthermore, the pixel buffer in which developed the data which prepared the buffer 3 of operating and took the OR for 2 bits to this buffer 3 approximately (the direction of Y), and non-recording pixel data carried out the board in the direction of Y by 2 pixels is created. The pixel data with which non-recording pixel data swelled by 2 pixels all around above are obtained by the operating buffer 3.

[0146] Next, the operating buffer 4 is prepared and the data which took the AND of the buffer 3 which is board data of said non-recording pixel, and the print buffer which is record pixel data on this buffer 4 are developed. The pixel data which remained on this buffer 4 at this time serve as the edge section to which a record pixel exists in 2 pixels of perimeters of a non-recording pixel. Furthermore, the operating buffer 5 is prepared and the data which took the logical difference of the print buffer which is said record pixel data, and the buffer 4 which is data of said edge section on this buffer 5 are developed.

[0147] By the above-mentioned explanation, in order to make an understanding of a method easy, the case where five operating buffers were used was explained, but it is easy to be natural even if it is the method which processes all on one buffer.

[0148] Although there will be no limit if it is more than the number of dots (since it is 2 pixels of perimeters with this operation gestalt 5x5-pixel size) detected for boundary detection as dot size (bit map size) in every direction used as one unit, it is easy to make width one line of record size and to make length an equivalent for the nozzle of a head in many cases.

[0149] Furthermore, even if an OR and an AND use the function of CPU, they may be a method processed by hard logic. It is also possible to swell at coincidence in every direction in hard

processing, and high-speed processing can be attained. Moreover, although bitwise processing, or a cutting tool unit or word unit processing is sufficient, it cannot be overemphasized that to process in a big unit is [high-speed processing] more possible.

[0150] Although the OR of a 2-dot pixel on either side was taken above as a means swollen 2 dots right and left, for example by the method of an escape of a dot. Although the activity buffer which is an expansion place will serve as a big data area for $n \times 8$ pixels by 8 pixels rightward supposing it extends a dot by 8 pixels to a uni directional, for example, the right, (giving an OR rightward by 8 pixels from an attention dot) and a developing agency buffer is a data area for n pixels in the direction of X. The area for 4 pixels of the edge of this X direction in area is thrown away, and the data same with having taken the OR of 4 pixels of right and left by extracting the data of the location of a $** (n-4)$ pixel from the location of the 5th pixel of the direction of X are obtained. Although it may be easier to have been able to limit [rather than] only to refer to the front or refer to the back with reference to the address in order depending on the algorithm and hard logic configuration on software, this means is effective when such.

[0151] Thus, by detecting the edge section of an image, the image which should be recorded is separable into the edge section and the non-edge section. This operation gestalt is realized by setting up after this separation, so that the edge section may be recorded only in record ink, and setting up so that the non-edge section may be recorded on the both sides of record ink and clear ink. Moreover, he is trying not to record the dot in the non-edge section which adjoins the edge section as shown in drawing 61 in this operation gestalt. That is, the image is formed by vacating by 1 dot between the edge section and a non-edge. Thus, by leaving the clearance for 1 dot, the dot of the edge section will become independent and the edge of an image is emphasized more. Moreover, by leaving the clearance for 1 dot, since the evil in which the dot of an edge part and the dot of a non-edge part will mix and spread is reduced, an edge part can form in Sharp. In addition, as shown in drawing 61, the dot which should be recorded essentially will be thinned out by preparing the clearance for 1 dot between the edge section and the non-edge section, but since an edge is emphasized by this and an image grace improves, it is satisfactory. Without on the other hand an edge part and a non-edge part distinguishing like drawing 62, if both parts are recorded on the both sides of record ink and clear ink, an edge will not be emphasized. In addition, drawing at the time of above-mentioned drawing 61 recording the edge section only in record ink, and recording the non-edge section on the both sides of record ink and clear ink is shown, and above-mentioned drawing 62 shows drawing at the time of also recording the non-[the edge section or] edge section on the both sides of record ink and clear ink. And it is shown that drawing 61 and drawing 62 are breathing out record ink or record ink, and clear ink in each location of the horizontal-scanning locations X1, X2, X3, and X4.

[0152] Here, the case where image recording is performed is explained using the head of 1200dpi as shown in drawing 10. Drawing 63 is the block diagram showing image data processing of an ink jet recording apparatus. As shown in drawing 63, the above-mentioned edge section detection means 7004 performs storing in the edge section data print buffer 7005 of edge section data, and storing in the non-edge section data print buffer 7001 of non-edge section data for the image data first stored in the print buffer 7000. In addition, in the case of this operation gestalt, the non-edge section data print buffer 7001 has the capacity which can store the data for 128 rasters, and, on the other hand, the edge section data print buffer 7005 has the capacity which can store the data for 64 rasters.

[0153] Next, in the non-edge section data-processing section 7002, it processes to said non-edge section data so that non-edge section data can be recorded on the both sides of record ink and clear ink. It processes to non-edge section data so that a clear ink dot may surely be formed in the location which specifically adjoins the record ink dot which should be recorded — it comes out. That is, the one half of non-edge section data is recorded in record ink, and the remaining one half is recorded in clear ink. Furthermore, in order to leave the clearance for 1 dot between the edge section and the non-edge section, the data which are equivalent to 1 dot of an outermost shell among non-edge section data are eliminated. 1 dot which adjoins the edge section by carrying out like this among the dots which form the non-edge section will be recorded.

[0154] Moreover, in the edge section data-processing section 7006, it processes to said edge section data so that a clear ink dot may not be recorded only in record ink. It processes to edge section data so that a clear ink dot may not be formed in the location which specifically adjoins the record ink dot which should be recorded — it comes out.

[0155] Thus, it transmits to a recording head by using as transfer data (record data) the data which took the theoretical sum of edge section data and non-edge section data to which processing was performed. And based on this record data, an image is formed by the one pass. [0156] In addition, although [the above-mentioned explanation] it vacates by 1 dot between the edge section and a non-edge, the edge enhancement in this operation gestalt is not limited to this approach. For example, you may make it only a predetermined number thin out the dot which adjoins the edge section among the dots in the non-edge section. Doing in this way can also reduce the blot in the boundary of the edge section and the non-edge section. Moreover, an edge can be emphasized even if it makes it not thin out at all the dot in the non-edge section which adjoins the edge section. However, if it carries out from a viewpoint of forming the sharp edge section by reducing more a blot of the boundary of the edge section and the non-edge section, it is desirable in order of the approach of vacating by 1 dot between the edge section and a non-edge, the approach only a predetermined number thins out the dot in the non-edge section which adjoins the edge section, and the approach that does not thin out at all the dot in the non-edge section which adjoins the edge section.

[0157] In addition, although the recording apparatus is performing edge section detection of image data in the above-mentioned explanation, it is possible to take the system which sends image data and edge data to a recording apparatus by the host side who sends image data. In this case, image data is developed to a print buffer and edge data are developed to a direct edge data buffer. It is possible to acquire the same record approach and effectiveness as the operation gestalt mentioned above even if the body of a recording apparatus did not use an edge section detection means by this configuration.

[0158] According to this operation gestalt, it faces recording an image using the high density head by which the nozzle for record ink regurgitation and the nozzle for clear ink regurgitation have been arranged by turns as mentioned above. Moreover, the non-edge section can be formed by sufficient printing concentration, without becoming possible to emphasize the edge section and reducing a recording rate by recording the edge section only in record ink and recording the non-edge section on the both sides of record ink and clear ink. Therefore, it becomes possible to record the high-definition image which has the clear edge section by using this operation gestalt for a short time. Moreover, more effective edge enhancement can be performed by not recording the dot in the non-edge section which adjoins the edge section. [0159] [9th operation gestalt] Next, the 9th operation gestalt of this invention is explained. With this 9th operation gestalt, it is characterized by recording the edge section in an alphabetic character field by the 1st recording mode, recording the non-edge section in an alphabetic character field by the 2nd recording mode, and recording a pattern field (ungrammatical sentence character field) by the 2nd recording mode. It explains especially here taking the case of the case where the image with which the alphabetic character field and the pattern field were intermingled is recorded. In addition, in order to explain this operation gestalt, drawing 17, drawing 18, and drawing 64 are used.

[0160] Drawing 64 is a flow chart which shows the procedure of the 9th operation gestalt, and the program for performing this processing is stored in ROM1701 of drawing 17. Moreover, the flow chart shown in drawing 64 is performed by MPU1710.

[0161] First, in step S1, a manuscript is read by the picture input device 150, and an image is inputted. It is a full color image like the GURABIRA journal which has as a manuscript the multi-colored picture image with which the alphabetic character field and the pattern field were intermingled, for example, and the full color image read by the picture input device 150 is changed into digital data, and is inputted into a host computer 1710 through the interface section 1703 as multiple-value image data of R-G-B. Next, it was inputted in step S2. The multiple-value image data of R-G-B is the image-processing section 1704, and is changed into the binary data of Y-M-C-Bk in which an output is possible with the ink jet recording apparatus

100. Then, in step S3, the alphabetic character judging of whether to be an alphabetic character is performed to each Y-M-C-Bk data made binary. That is, an alphabetic character field is extracted.

[0162] If it is the alphabetic character field which is an alphabetic character, it will progress to step S4, and an alphabetic character field is divided into the edge section and the non-edge section by detecting the edge section of an alphabetic character field by step S4. Then, in step S5, the edge section is set up so that the 1st recording mode may be recorded, and in step S7, the non-edge section is set up so that the 2nd recording mode may be recorded. That is, the field judged to be the edge section of an alphabetic character field is recorded only in record ink, and the field judged to be the non-edge section of an alphabetic character field is recorded using the both sides of record ink and clear ink. If the 1st recording mode is set up at step S5, the record image data for recording the edge section of said alphabetic character field in step S6 will be created. Let the data obtained here be Data C. Then, it progresses to step S11.

[0163] Moreover, if the 2nd recording mode is set up at step S7, the record image data for recording the non-edge section of said alphabetic character field in step S8 will be created. Let the data obtained here be Data D. Then, it progresses to step S11. In addition, the approach of dividing an alphabetic character field into the edge section and the non-edge section in step S4 is performed by using the solid field detecting element of the edge section detection means of the operation gestalt of the above 1st, or the 2nd operation gestalt.

[0164] On the other hand, if it is the pattern field which is not an alphabetic character, it will progress to step S9, and it sets up so that the pattern field may be recorded by the 2nd recording mode. That is, the field judged to be a pattern field is recorded using the both sides of record ink and clear ink. If the 2nd recording mode is set up by step S9, the record image data for recording said pattern field in step S10 will be created. Let the data obtained here be Data E. Then, it progresses to step S11.

[0165] In step S11, the edge section data of an alphabetic character field, the non-edge section data of an alphabetic character field, and the data of a pattern field are combined. A theoretical product with the data E obtained in order to record Data D and the pattern field which were obtained in order to record the non-edge section of Data C and an alphabetic character field specifically obtained in order to record the edge section of an alphabetic character field is taken, and let this be record data.

[0166] Thus, the obtained record data are transmitted to the ink jet recording apparatus 100 through the interface section 1603, and record is performed by the ink jet recording apparatus.

The record image which recorded the edge section of an alphabetic character field only in record ink, and recorded the non-edge section of an alphabetic character field and a pattern field on the both sides of record ink and clear ink by the above is formed. In addition, the alphabetic character judging (alphabetic character extract) of step S3 in drawing 64 can use the approach explained in the operation gestalt of the above 2nd.

[0167] In addition, in the flow chart of drawing 28 concerning the 9th operation gestalt, according to the inputted image data (are they the edge section of an alphabetic character field, the non-edge section of an alphabetic character field, and a pattern field?), although the host computer has set up the 1st recording mode and 2nd recording mode automatically, it is not limited to this. That is, a user may perform setting out of the 1st recording mode and the 2nd recording mode.

In this case, a switch and a panel are prepared in an ink jet recording apparatus, and it is possible that this sets up the mode. Or a user may set up by the printer driver processed within a host computer, or you may carry out. Thus, when a user sets up, there is an advantage that an image can be outputted according to a user's application or liking. On the other hand, when a host computer sets up automatically, since a user has to do nothing, he has the advantage that actuation of a user is easy.

[0168] In addition, although the case where the image with which the alphabetic character field and the pattern field were intermingled above was recorded was shown, naturally this operation gestalt can be applied, without being limited to this, also when recording the image of only an alphabetic character, and the image of only a pattern.

[0169] According to this operation gestalt, it faces recording an image using the high density

head by which the nozzle for record ink regurgitation and the nozzle for clear ink regurgitation have been arranged by turns as mentioned above. The ungrammatical sentence character field (pattern field) where gradation nature is demanded is recorded on the both sides of record ink and clear ink. The clear alphabetic character in which the edge section of the alphabetic character field where gradation nature is not demanded was recorded only in record ink, the non-edge section of an alphabetic character field is making it record on the both sides of record ink and clear ink, and the pattern field excellent in gradation nature could be formed, and edge enhancement was given can be formed. Therefore, the high-definition image which has the pattern field which was excellent in using this operation gestalt at gradation nature even when the image with which the pattern field and the alphabetic character field were intermingled was recorded, and a clear alphabetic character becomes recordable.

[0170] The 8th operation gestalt and the 9th operation gestalt which carried out [operation gestalt of ** 10th] **** are performing one-pass record by setting up either the 1st recording mode or the 2nd recording mode. According to the operation gestalt and the 9th operation gestalt of the above 8th, since a sufficiently high-definition image can be formed in a short time, it thinks [that one-pass record is enough in many cases and]. However, even if chart lasting time becomes long depending on a user's application and image which should be liked or recorded, it may be more desirable to form a more nearly high-definition image. In such a case, recording by the multi-pass method is desirable. Namely, it records by setting up the 3rd recording mode and 4th recording mode. In addition, if the 3rd recording mode is set up, the predetermined field will be only record ink, and will be recorded by the scan of multiple times, and if the 4th recording mode is set up, the predetermined field will be the both sides of record ink and clear ink, and will be recorded by the scan of multiple times. A user may set up setting out of this 3rd recording mode and the 4th recording mode by the switch or the panel for having prepared for the ink jet recording apparatus, and may set it up by the printer driver processed within a host computer. Moreover, according to image data, a host computer or an ink jet recording device may set up automatically like the 8th operation gestalt and the 9th operation gestalt. In this case, you may make it always set up either the 3rd recording mode or the 4th recording mode, and may make it set up any one of the 1st, 2nd, 3rd, or 4th recording mode according to image data.

[0171] using the 3rd recording mode or 4th recording mode which records by the multi-pass method as mentioned above according to this operation gestalt -- operation gestalt [of ** a 1st] -- although time amount will be taken for a long time rather than the 3rd operation gestalt -- instead, operation gestalt [of ** a 1st] -- formation of an image more nearly high-definition than the 3rd operation gestalt is attained.

[0172] operation gestalt [of the operation gestalt] above 1st] -- besides [--- with the 10th operation gestalt, although clear ink is made to reach the contiguity section of a record dot, this is not limited to clear ink. What is necessary is just to be able to change the coat condition of a record dot, without changing a hue substantially, in order to realize this invention. Therefore, what is necessary is just the liquid which does not contain color material. What is necessary is just the liquid which will distribute the pigment and will be held to homogeneity that what is necessary is just the liquid which will dissolve the color especially if the color material of a record dot is a color if the color material of a record dot is a pigment. And although clear ink is used also in the liquid which does not contain color material substantially, it is suitable for this invention. Because, compatibility with the color material in the record dot which made clear ink reach the target on a medium is from ** at homogeneity. Moreover, clear ink is because it is what is prescribed so that it may be easy discharge good from an ink delivery. Moreover, since this clear ink can be used in common to the record ink of each color, even if it prepares plurality, for example, three colors of CMY, or more than it for the record ink containing color material, the gradation expression of this clear ink can be efficiently carried out rather than it is good as one kind is prepared, and it prepares shade ink in each color.

[0173] Moreover, although the head by which the ink regurgitation nozzle and the clear ink regurgitation nozzle have been arranged by turns for every nozzle is used with the above-mentioned operation gestalt, this invention is not limited to this. For example, the head of clear

substrate and a nozzle can be formed.

[0182] Drawing 43 is drawing having shown the condition of discharging the pressure generating

[0183] By this invention, an image may be recorded using the above piezo ink jet heads by carrying out the regurgitation of record ink and the clear ink from this piezo ink jet head. However, since the densification of a nozzle is more difficult for a piezo ink jet head than a bubble jet head in the actual condition, to this invention, the bubble jet head is more desirable, considering the viewpoint of densification.

[0185] In addition, it cannot be overemphasized by supplying the storage which recorded the program code of the software which realizes the function of the operation gestalt mentioned above to a system or equipment, and carrying out read-out activation of the program code with which the computer (or CPU and MPU) of the system or equipment was stored in the storage that the object of this invention is attained.

invention, the head by which the ink regurgitation nozzle and the liquid regurgitation direction is used. [0185] In addition, it cannot be overemphasized by supplying the storage which recorded the program code of the software which realizes the function of the operation gestalt mentioned above to a system or equipment, and carrying out read-out activation of the program code with which the computer (or CPU and MPU) of the system or equipment was stored in the storage that the object of this invention is attained.

[0186] In this case, the storage which memorized that program code will constitute this invention by realizing the function of the operation gestalt which the program code itself read from the storage mentioned above.

[0187] As a storage for supplying a program code, a floppy disk, a hard disk, an optical disk, a magneto-optic disk, CD-ROM, CD-R, a magnetic tape, the memory card of a non-volatile, ROM, etc. can be used, for example.

[0188] Moreover, it cannot be overemphasized that it is contained also when the function of the operation gestalt which performed a part or all of processing that OS (operating system) which is working on a computer is actual, based on directions of the program code, and the function of the example of an operation gestalt mentioned above by performing the program code which the computer read is not only realized, but was mentioned above by the processing is realized.

[0189] Furthermore, after the program code read from a storage is written in the memory with which the functional expansion unit connected to the functional add-in board inserted in the computer or a computer is equipped, it cannot be overemphasized that it is contained also when the function of the operation gestalt which performed a part or all of processing that CPU with which the functional add-in board and functional expansion unit are equipped based on directions of the program code is actual, and mentioned above by the processing is realized.

[0190] In addition, although this invention can apply various ink jet recording methods, it is equipped with means (for example, an electric thermal-conversion object, a laser beam, etc.) to generate heat energy as energy used in order to make the ink regurgitation especially perform also in it, and brings about the effectiveness which was excellent in the print head of a method which makes the change of state of ink occur with said heat energy, and the printing equipment. It is because the densification of a print and highly minute-ization can be attained according to this method.

[0191] About the typical configuration and typical principle, what is performed using the fundamental principle currently indicated by the U.S. Pat. No. 4723129 description and the 4740796 description, for example is desirable. Although this method is applicable to both the so-called mold on demand and a continuous system. On the electric thermal-conversion object which is especially arranged corresponding to the sheet and liquid route where the liquid (ink) is held in the case of the mold on demand. By impressing at least one driving signal which gives the rapid temperature rise which supports print information and exceeds nucleate boiling. Since make an electric thermal-conversion object generate heat energy, the heat operating surface of a print head is made to produce film boiling and the air bubbles in the liquid (ink) corresponding to this driving signal can be formed by one to one as a result, it is effective. A liquid (ink) is made to breathe out through opening for regurgitation by growth of these air bubbles, and contraction, and at least one drop is formed. If this driving signal is made into a pulse configuration, since growth contraction of air bubbles will be performed appropriately instantly, the regurgitation of a liquid (ink) excellent in especially responsibility can be attained, and it is more desirable. As a driving signal of this pulse configuration, what is indicated by the U.S. Pat. No. 4463359 description and the 4345262 description is suitable. In addition, if the conditions indicated by the U.S. Pat. No. 4313124 description of invention about the rate of a temperature rise of the above-mentioned heat operating surface are adopted, the further excellent print can be performed.

[0192] As a configuration of a print head, the configuration using the U.S. Pat. No. 4558333 description and U.S. Pat. No. 4459600 description which indicate the configuration arranged to the field to which the heat operation section other than the combination configuration (a straight-line-like liquid flow channel or right-angle liquid flow channel) of a delivery which is indicated by each above-mentioned description, a liquid route, and an electric thermal-conversion object is crooked is also included in this invention. In addition, the effectiveness of this invention is effective also as a configuration based on JP.59-138461A which indicates the configuration whose puncturing which absorbs the pressure wave of JP.59-123670A which indicates the configuration which uses a common slit as the discharge part of an electric thermal-conversion object to two or more electric thermal-conversion objects, or heat energy is made to correspond to a discharge part. Namely, no matter the gestalt of a print head may be

what thing, it is because it can print now efficiently certainly according to this invention.

[0193] Furthermore, this invention is effectively applicable also to the full line type print head which has the die length corresponding to the maximum width of the print medium which can print a printing equipment. As such a print head, any of the configuration which fills the die length with the combination of two or more print heads, and the configuration as one print head formed in one are sufficient.

[0194] In addition, this invention is effective also when the thing of a serial type like the example of a top also uses the print head exchangeable chip type to which the electric connection with the body of equipment and supply of the ink from the body of equipment are attained by the print head fixed to the body of equipment or the body of equipment being equipped, or the print head of the cartridge type with which the ink tank was formed in the print head itself in one.

[0195] Moreover, since the effectiveness of this invention can be stabilized further, it is desirable to add the recovery means against a print head formed in this invention as a configuration of a printing equipment, a preliminary auxiliary means, etc. If these are mentioned concretely, it is effective in order to perform the print stabilized by performing the preheating means by the capping means, the cleaning means, the application of pressure or the attraction means, the electric thermal-conversion object, the heating elements different from this, or such combination over a print head, and reserve regurgitation mode in which the regurgitation different from a print is performed.

[0196] Moreover, although only one piece was prepared also about the class thru/or the number of a print head carried, for example corresponding to monochromatic ink, corresponding to two or more ink which differs in an others and print color or concentration, more than one may be prepared the number of pieces. That is, although not only the printing mode of only mainstream colors, such as black, but a print head may be constituted in one as a printing mode of a printing equipment or the paddle gap by two or more combination is sufficient, for example, this invention is very effective also in equipment equipped with full color at least one by the double color color of a different color, or color mixture.

[0197] Furthermore, in addition, in this invention example explained above, although ink is explained as a liquid. What is ink solidified less than [a room temperature or it], and is softened or liquefied at a room temperature. Or by the ink jet method, since what carries out temperature control is common as a temperature control is performed for ink itself within the limits of 30 degrees C or more 70 degrees C or less and it is in the stability regurgitation range about the viscosity of ink, ink should just make the shape of liquid at the time of activity print signal grant. In addition, it carries out whether the ink which prevents by making the temperature up by heat energy use it positively as energy of the change of state from a solid condition to the liquid condition of ink, or is solidified in the state of neglect for the purpose of antiflashing of ink is used. Anyway, ink liquefies by grant according to the print signal of heat energy. This invention can be applied also when using the ink of the property which will not be liquefied without heat energy, such as that by which liquefied ink is breathed out, and a thing which it already begins to solidify when reaching a print medium. The ink in such a case is good for a porosity sheet device or a breakthrough which is indicated by JP.54-56847A or JP.60-71260A also as liquefied or a gestalt which counters to an electric thermal-conversion object in the condition of having been held as a solid. In this invention, the most effective thing performs the film-boiling method mentioned above to each ink mentioned above.

[0198] Furthermore, in addition, as a gestalt of the printing equipment equipped with the print engine which uses the fluid injection print head of this invention, although used as an image printing terminal of information management systems, such as a computer, the gestalt of the reproducing unit combined with others, a reader, etc. and the facsimile apparatus which has a transceiver function further may be taken.

[0199]

[Effect of the Invention] According to this invention, it becomes possible to reconcile the both sides of high-definition-izing and improvement in the speed of an ink regurgitation nozzle and a liquid regurgitation nozzle by using the high density recording head arranged by turns as mentioned above.

[0200] Moreover, the number of gradation of halftone can be made to increase by forming an image using the both sides of record ink and clear ink, without reducing output resolution. The expression of smooth gradation is attained by that cause, and the granular feeling in the highlights section is also reduced.

[0201] Moreover, by using the inline-type head which has the nozzle train which the ink regurgitation nozzle and the liquid regurgitation nozzle arranged, it cannot be accompanied by enlargement or a cost rise of equipment, but high-definition-izing and improvement in the speed can be realized.

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* NOTICES *

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the outline block diagram of a recording head carried in an ink jet recording device applicable to this invention, and the recording head (linear array mold recording head) by which the nozzle was arranged linearly is shown.

[Drawing 2] It is drawing showing the configuration of the recording head unit 9 possessing two or more recording heads 90 shown in drawing 1 , and (a) shows the case where the linear array mold recording head 90 shown by drawing 1 is arranged to a horizontal single tier, and (b) shows the case where the linear array mold recording head 90 shown by drawing 1 is arranged to a vertical single tier.

[Drawing 3] It is the perspective view showing an example of the ink jet recording device of a serial mold applicable to this invention.

[Drawing 4] It is the perspective view showing an example of the ink jet recording device of a line mold applicable to this invention.

[Drawing 5] It is drawing showing record actuation of the ink jet recording device of a serial mold.

[Drawing 6] It is drawing showing the configuration of the regurgitation element of a bubble jet head.

[Drawing 7] It is the schematic diagram showing the configuration of a bubble jet head.

[Drawing 8] It is the schematic diagram showing the configuration of a bubble jet head.

[Drawing 9] It is drawing showing an example of the liquid flow channel for supplying record ink and clear ink to a nozzle train by turns, and (a) is [the transparence front view (c) of a transparence perspective view and (b)] a side-face sectional view.

[Drawing 10] It is drawing showing the case where it records based on the recording mode using the both sides of record ink and clear ink, and it is shown that (a) drives at least one nozzle for clear ink regurgitation both which adjoins the nozzle for record ink regurgitation and it, and (b) shows signs that the record ink dot and clear ink dot which reached the target on recorded media have mixed.

[Drawing 11] It is drawing showing the head of 1200dpi, and it is shown that record ink is supplied to all nozzles.

[Drawing 12] It is drawing showing the head of 1200dpi, and it is shown that record ink is supplied to the nozzle in every other one.

[Drawing 13] An ink regurgitation nozzle and a clear ink regurgitation nozzle are drawings showing the recording head arranged by turns, and driving only the ink regurgitation nozzle is shown.

[Drawing 14] It is drawing showing the case where it records based on the recording mode using the both sides of record ink and clear ink, and it is shown that (a) drives both two nozzles for clear ink regurgitation that adjoin the nozzle for record ink regurgitation and it, and (b) shows signs that the record ink dot and clear ink dot which reached the target on recorded media contact, and the dot of the both sides mixes.

[Drawing 15] Solid concentration is drawing showing the relation of the dot coverage and optical reflection density (OD value) in the 1st ink of Ds, and the ink whose solid concentration is two

kinds of the 2nd ink of Ds/2.

[Drawing 16] It is the block diagram of the ink jet recording apparatus shown in drawing 3 .

[Drawing 17] It is the block diagram showing the configuration of the control system of a host computer 1710.

[Drawing 18] It is the block diagram showing the configuration of the solid section detecting element 1705.

[Drawing 19] It is the flow chart which shows the procedure concerning the 1st example of an operation form gestalt.

[Drawing 20] It is drawing showing the example which pursued the border line of one pixel set.

[Drawing 21] It is drawing showing the direction of a border line.

[Drawing 22] It is the flow chart which shows the procedure concerning the 2nd example of an operation form gestalt.

[Drawing 23] It is the flow chart which shows the procedure of the alphabetic character judging in drawing 22 .

[Drawing 24] It is drawing showing notionally the 1-dimensional projection data of the direction of X.

[Drawing 25] It is drawing showing notionally the characteristic quantity caught from projection data.

[Drawing 26] It is drawing for explaining other methods of performing an alphabetic character judging.

[Drawing 27] It is drawing for explaining other methods of performing an alphabetic character judging.

[Drawing 28] It is drawing having shown signs that the coat condition of a record dot changed by contacting clear ink and a record dot.

[Drawing 29] It is the dot pattern which has arranged the record dot and the clear ink dot in a dot matrix.

[Drawing 30] It is drawing showing an example of the dot pattern expressing gradation.

[Drawing 31] It is drawing showing an example of the dot pattern expressing gradation.

[Drawing 32] It is drawing showing an example of the dot pattern expressing gradation.

[Drawing 33] It is drawing showing an example of the dot pattern expressing gradation.

[Drawing 34] It is the flow chart which shows the 4th operation gestalt.

[Drawing 35] It is production process drawing showing a conventional piezo ink jet head and its conventional manufacture approach.

[Drawing 36] It is production process drawing of a piezo ink jet head.

[Drawing 37] It is production process drawing of a piezo ink jet head.

[Drawing 38] It is the perspective view of an ink jet head applicable to this invention.

[Drawing 39] It is drawing of longitudinal section of an ink jet head applicable to this invention.

[Drawing 40] It is drawing of longitudinal section of an ink jet head applicable to this invention, and is drawing in the condition that the pressure generating member has shrunk.

[Drawing 41] It is drawing of longitudinal section of an ink jet head applicable to this invention, and is drawing in the condition that the pressure generating member is extended.

[Drawing 42] It is an explanatory view of operation in case a pressure generating member is shrunk.

[Drawing 43] It is an explanatory view of operation in case a pressure generating member is extended.

[Drawing 44] It is the perspective view of a pressure-producing part.

[Drawing 45] It is the outline block diagram of a recording head carried in an ink jet recording device applicable to this invention, and the recording head (staggered arrangement mold recording head) by which the nozzle was arranged alternately is shown.

[Drawing 46] It is drawing which made 1 dot of record ink, and 1 dot of clear ink reach recorded media, and (a) is the case where record ink and clear ink are made to reach an adjoining location, and (b) is the case where record ink and clear ink are made to reach the same location.

[Drawing 47] It is drawing having shown performing solid printing on the both sides of record ink and clear ink.

[Drawing 48] It is the outline block diagram of a recording head applicable with the 5th operation gestalt, and (a) is the recording head (linear array mold recording head) by which the nozzle for clear ink regurgitation with a large path was arranged linearly relatively [nozzle / with a small path / for record ink regurgitation] relatively, and (b) is the recording head (staggered arrangement mold recording head) by which these nozzles were arranged alternately.

[Drawing 49] It is drawing showing the configuration of the recording head unit 9 possessing two or more recording heads 90 shown in drawing 48 , and (a) shows the case where the linear array mold recording head 90 shown by drawing 48 is arranged to a horizontal single tier, and (b) shows the case where the linear array mold recording head 90 shown by drawing 48 is arranged to a vertical single tier.

[Drawing 50] It is drawing showing the case where it records based on the recording mode only using record ink, and the case where it records based on the recording mode using the both sides of record ink and clear ink, using a head applicable with the 5th operation gestalt.

[Drawing 51] It is the outline block diagram of a recording head applicable with the 6th operation gestalt, and (a) is the recording head (linear array mold recording head) by which the nozzle for record ink regurgitation with a large path was arranged linearly relatively [nozzle / with a small path / for clear ink regurgitation] relatively, and (b) is the recording head (staggered arrangement mold recording head) by which these nozzles were arranged alternately.

[Drawing 52] It is drawing showing the configuration of the recording head unit 9 possessing two or more recording heads 90 shown in drawing 51 , and (a) shows the case where the linear array mold recording head 90 shown by drawing 51 is arranged to a horizontal single tier, and (b) shows the case where the linear array mold recording head 90 shown by drawing 51 is arranged to a vertical single tier.

[Drawing 53] It is drawing showing the case where it records based on the recording mode only using record ink, and the case where it records based on the recording mode using the both sides of record ink and clear ink, using a head applicable with the 6th operation gestalt.

[Drawing 54] The case where an image is recorded by two scans using the conventional record approach is shown.

[Drawing 55] It is drawing having shown the case where the regurgitation of the clear ink was carried out in the bond part between scans.

[Drawing 56] It is drawing for explaining the one-pass record which records an image by carrying out the relative scan of the recording head only once to fields other than the bond part by each scan.

[Drawing 57] It is drawing for explaining the two pass record which records an image by carrying out the relative scan of the recording head twice to fields other than the bond part by each scan.

[Drawing 58] It is the block diagram showing the control circuit for performing control of each part of the ink jet recording apparatus concerning the 8th operation gestalt.

[Drawing 59] It is the circuit diagram showing the detail of each part of drawing 58 .

[Drawing 60] It is drawing explaining printing data flow.

[Drawing 61] It is drawing showing the case where recorded the edge section only in record ink and the non-edge section is recorded on the both sides of record ink and clear ink.

[Drawing 62] It is drawing showing the case where the non-[the edge section or] edge section is also recorded on the both sides of record ink and clear ink.

[Drawing 63] It is the block diagram of image data processing of the ink jet recording apparatus by the 8th operation gestalt.

[Drawing 64] It is the flow chart which shows the procedure concerning the 9th example of an operation form gestalt.

[Description of Notations]

1 Recorded Media

2 Feed Roller

3 Vertical-Scanning Motor

4 Conveyance Roller

5 Conveyance Roller

6 Guide Rail
7 Guide Rail
9 Recording Head Unit
12 Record Ink Tank
13 Clear Ink Tank
90 Recording Head
93 Nozzle for Record Ink Regurgitation
95 Nozzle for Clear Ink Regurgitation
100 Ink Jet Recording Device
150 Picture Input Device
1700 MPU
1701 ROM
1702 RAM
1703 Interface Section
1704 Image-Processing Section
1705 Solid Field Detecting Element
1707 Control Unit
1710 Host Computer
7000 Print Buffer
7001 Non-Edge Section Data Print Buffer
7002 Non-Edge Section Data-Processing Section
7004 Edge Section Detection Means
7005 Edge Section Data Print Buffer
7006 Edge Section Data-Processing Section

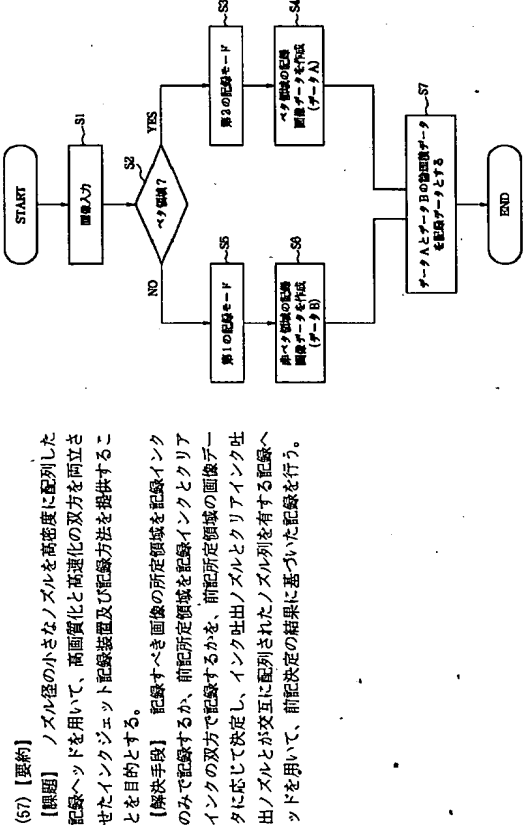
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(54)【発明の名称】 インクジェット記録方法、インクジェット記録装置、コンピュータ可読記憶媒体およびプログラム



【特許請求の範囲】

- 【請求項1】 色材を含有するインクを吐出するための少なくとも1つのインク吐出ノズルと色材を實質的に含有しない液体を吐出するための少なくとも1つの液体吐出ノズルとが所定の方向に交互に隣接して配置されたノズル列を有する記録ヘッドを用い、前記記録ヘッドと被記録媒体とを相対的に走査させながら、前記インクと前記液体とを前記被記録媒体に吐出することで画像を記録するインクジェット記録方法であって、
- 記録すべき画像中の少なくとも一部の領域を前記インクのみで記録するか、前記領域を前記インクと前記液体の双方で記録するかを決定する決定工程と、
- 前記決定工程による決定結果に基づき前記領域の記録を行う記録工程とを備え、
- 前記領域を前記インクと前記液体の双方で記録する場合、前記記録工程では、所定のインク吐出ノズルから吐出されるインクと前記所定のインク吐出ノズルに隣接する液体吐出ノズルから吐出される液体のそれぞれが前記被記録媒体上の異なる位置に着弾し、前記着弾したインクと前記着弾した液体とが前記被記録媒体上で接触することを特徴とするインクジェット記録方法。
- 【請求項2】 前記所定のインク吐出ノズルから吐出されたインクと前記所定のインク吐出ノズルに隣接する液体吐出ノズルから吐出された液体とは、同一走査中に吐出されることを特徴とする請求項1に記載のインクジェット記録方法。
- 【請求項3】 前記所定のインク吐出ノズルから吐出されたインクと前記所定のインク吐出ノズルに隣接する液体吐出ノズルから吐出された液体とは、前記被記録媒体上において液状で混和することを特徴とする請求項1または2に記載のインクジェット記録方法。
- 【請求項4】 前記決定工程では、前記領域が非ベタ領域のとき前記インクのみで記録するように決定し、前記領域がベタ領域のとき前記インクと前記液体の双方で記録するように決定することを特徴とする請求項1乃至3のいずれかに記載のインクジェット記録方法。
- 【請求項5】 前記決定工程では、前記領域が文字領域のとき前記インクのみで記録するように決定し、前記領域が非文字領域のとき前記インクと前記液体の双方で記録するように決定することを特徴とする請求項1乃至3のいずれかに記載のインクジェット記録方法。
- 【請求項6】 前記決定工程では、記録すべき画像の種類と記録速度モードに応じて、前記領域を前記インクのみで記録するか、前記領域を前記インクと前記液体の双方で記録するかを決定することを特徴とする請求項1乃至3のいずれかに記載のインクジェット記録方法。
- 【請求項7】 前記記録すべき画像の種類とは、文書画像、非文書画像、文書画像と非文書画像とが混在した画像からなる群から選ばれたいずれか1つであることを特徴とする請求項6に記載のインクジェット記録方法。

- (2) 特開2001-205827
- 【請求項8】 前記記録速度モードとは、被記録媒体の1ラインを記録ヘッドの1回の主走査で記録する高速モードまたは被記録媒体の1ラインを記録ヘッドの複数回の主走査で記録する高品位モードであることを特徴とする請求項6に記載のインクジェット記録方法。
- 【請求項9】 前記記録すべき画像の種類と前記記録速度モードとは、ユーザーが選択することを特徴とする請求項6乃至8のいずれかに記載のインクジェット記録方法。
- 【請求項10】 前記決定工程では、記録すべき画像のエッジ部を前記インクのみで記録するように決定し、前記画像の非エッジ部を前記インクと前記液体との双方で記録するように決定することを特徴とする請求項1乃至3のいずれかに記載のインクジェット記録方法。
- 【請求項11】 前記画像のエッジ部と非エッジ部とを分離する工程を更に備えることを特徴とする請求項10に記載のインクジェット記録方法。
- 【請求項12】 前記インクによるインクドットと前記液体による液体ドットの双方のドットによって前記非エッジ部を記録するに際し、前記エッジ部と隣接する前記エッジ部のドットは記録しないことを特徴とする請求項10または11に記載のインクジェット記録方法。
- 【請求項13】 前記インクによるインクドットと前記液体による液体ドットの双方のドットによって前記非エッジ部を記録するに際し、前記エッジ部と隣接する前記エッジ部のドットは間引いて記録することを特徴とする請求項10または11に記載のインクジェット記録方法。
- 【請求項14】 前記画像とは、文字、線画、図からなる群から選ばれた少なくとも1種であることを特徴とする請求項10乃至13のいずれかに記載のインクジェット記録方法。
- 【請求項15】 前記記録すべき画像中の文字領域を抽出する工程と、
- 前記抽出された文字領域のエッジ部と非エッジ部とを分離する工程とを備え、
- 前記決定工程では、前記エッジ部を前記インクのみで記録するように決定し、前記非エッジ部を前記インクと前記液体との双方で記録するように決定し、前記抽出した文字領域以外の非文字領域を前記インクと前記液体との双方で記録するように決定することを特徴とする請求項1に記載のインクジェット記録方法。
- 【請求項16】 前記エッジ部は、インクに熱を付与することで気泡を発生させ、前記気泡の発生に基づき、インクを吐出させる熱エネルギー発生手段を具備することを特徴とする請求項1乃至15のいずれかに記載のインクジェット記録方法。
- 【請求項17】 前記色材を實質的に含有しない液体とは、前記インクから色材を除去したクリヤインクであることを特徴とする請求項1乃至16のいずれかに記載の

インクジェット記録方法。

【請求項18】 色材を含有するインクを吐出するため、の少なくとも1つのインク吐出ノズルと色材を実質的に含有しない液体を吐出するための少なくとも1つの液体吐出ノズルとが所定の方向に交互に隣接して配置されたノズル列を有する記録ヘッドを用い、前記記録ヘッドと被記録媒体とを相対的に走査させながら、前記インクと前記液体を前記被記録媒体に吐出することで画像を記録するインクジェット記録装置であって、

記録すべき画像中の少なくとも一部の領域を前記インクのみで記録するか、前記領域を前記インクと前記液体の双方で記録するかを決定する決定手段と、

前記決定手段による決定結果に基づいた記録がなされるように前記記録ヘッドを制御する記録制御手段とを備え、

前記領域を前記インクと前記液体の双方で記録する場合、所定のインク吐出ノズルから吐出されるインクと前記所定のインク吐出ノズルに隣接する液体吐出ノズルから吐出される液体のそれぞれが前記被記録媒体上の異なる位置に着弾し、前記着弾したインクと前記着弾した液体とが前記被記録媒体上で接触することを特徴とするインクジェット記録装置。

【請求項19】 前記所定のインク吐出ノズルから吐出されたインクと前記所定のインク吐出ノズルに隣接する液体吐出ノズルから吐出された液体とは、同一走査中に吐出されることを特徴とする請求項18に記載のインクジェット記録装置。

【請求項20】 前記所定のインク吐出ノズルから吐出されたインクと前記所定のインク吐出ノズルに隣接する液体吐出ノズルから吐出された液体とは、前記被記録媒体上において液体で湿潤することを特徴とする請求項18または19に記載のインクジェット記録装置。

【請求項21】 前記決定手段は、前記領域が非ベタ領域のとき前記インクのみで記録するように決定し、前記領域がベタ領域のとき前記インクと前記液体の双方で記録するように決定することを特徴とする請求項18乃至20のいずれかに記載のインクジェット記録装置。

【請求項22】 前記決定手段は、前記領域が文字領域のとき前記インクのみで記録するように決定し、前記領域が非文字領域のとき前記インクと前記液体の双方で記録するように決定することを特徴とする請求項18乃至20のいずれかに記載のインクジェット記録装置。

【請求項23】 前記決定手段は、記録すべき画像の種類と記録速度モードに応じて、前記領域を前記インクのみで記録するか、前記領域を前記インクと前記液体の双方で記録するかを決定することを特徴とする請求項18乃至20のいずれかに記載のインクジェット記録装置。

【請求項24】 前記記録すべき画像の種類とは、文書画像、非文書画像、文書画像と非文書画像とが混在した画像からなる群から選ばれたいずれか1つであることを

特徴とする請求項23に記載のインクジェット記録装置。

【請求項25】 前記記録速度モードとは、被記録媒体の1ラインを記録ヘッドの1回の主走査で記録する高速モードまたは被記録媒体の1ラインを記録ヘッドの複数回の主走査で記録する高品位モードであることを特徴とする請求項23に記載のインクジェット記録装置。

【請求項26】 前記記録すべき画像の種類と前記記録速度モードとは、ユーザーが選択することを特徴とする請求項23乃至25のいずれかに記載のインクジェット記録装置。

【請求項27】 前記決定手段は、記録すべき画像のインクと前記液体の双方で記録するように決定し、前記領域を前記インクと前記液体の双方で記録するように決定することを特徴とする請求項18乃至20のいずれかに記載のインクジェット記録装置。

【請求項28】 前記画像のエッジ部と非エッジ部とを分離する手段を更に備えることを特徴とする請求項27に記載のインクジェット記録装置。

【請求項29】 前記インクによるインクドットと前記液体による液体ドットの双方のドットによって前記非エッジ部を記録するに際し、前記エッジ部と隣接する前記エッジ部のドットは記録しないことを特徴とする請求項27または28に記載のインクジェット記録装置。

【請求項30】 前記インクによるインクドットと前記液体による液体ドットの双方のドットによって前記非エッジ部を記録するに際し、前記エッジ部と隣接する前記エッジ部のドットは間引いて記録することを特徴とする請求項27または28に記載のインクジェット記録装置。

【請求項31】 前記画像とは、文字、線画、表からなる群から選ばれた少なくとも1種であることを特徴とする請求項27乃至30のいずれかに記載のインクジェット記録装置。

【請求項32】 前記記録すべき画像中の文字領域を抽出する抽出手段と、前記抽出された文字領域のエッジ部と非エッジ部とを分離する分離手段と更に備え、

前記決定手段は、前記エッジ部を前記インクのみで記録するように決定し、前記非エッジ部を前記インクと前記液体との双方で記録するように決定し、前記抽出した文字領域以外の非文字領域を前記インクと前記液体との双方で記録するように決定することを特徴とする請求項18に記載のインクジェット記録装置。

【請求項33】 前記記録ヘッドは、インクに熱を付与することで気泡を発生させ、前記気泡の発生に基づき、インクを吐出させる熱エネルギー発生手段を具備することを特徴とする請求項18乃至32のいずれかに記載のインクジェット記録装置。

【請求項34】 前記色材を実質的に含有しない液体と

は、前記インクから色材を除去したクリアインクである

する請求項38に記載のコンピュータ可読記録媒体。

【請求項41】 前記決定工程では、記録すべき画像のエッジ部を前記インクのみで記録するように決定し、前記画像の非エッジ部を前記インクと前記液体との双方で記録するように決定することを特徴とする請求項35に記載のコンピュータ可読記録媒体。

【請求項42】 前記画像のエッジ部と非エッジ部とを分離する工程を含むことを特徴とする請求項41に記載のコンピュータ可読記録媒体。

【請求項43】 前記インクによるインクドットと前記液体による液体ドットの双方のドットによって前記非エッジ部を記録するように決定された場合、前記エッジ部と隣接する前記非エッジ部のドットを特徴とする請求項41または42に記載のコンピュータ可読記録媒体。

【請求項44】 前記インクによるインクドットと前記液体による液体ドットの双方のドットによって前記非エッジ部を記録するように決定された場合、前記エッジ部と隣接する前記非エッジ部のドットが間引かれ記録されるように前記記録データを生成することを特徴とする請求項41または42に記載のコンピュータ可読記録媒体。

【請求項45】 前記画像とは、文字、線画、表からなる群から選ばれた少なくとも1種であることを特徴とする請求項41乃至44のいずれかに記載のコンピュータ可読記録媒体。

【請求項46】 前記記録すべき画像中の文字領域を抽出する工程と、前記抽出された文字領域のエッジ部と非エッジ部とを分離する工程とを含み、

前記決定工程では、前記エッジ部を前記インクのみで記録するように決定し、前記非エッジ部を前記インクと前記液体との双方で記録するように決定し、前記抽出した文字領域以外の非文字領域を前記インクと前記液体との双方で記録するように決定することを特徴とする請求項35に記載のコンピュータ可読記録媒体。

【請求項47】 色材を含有するインクを吐出するため、の少なくとも1つのインク吐出ノズルと色材を実質的に含有しない液体を吐出するための少なくとも1つの液体吐出ノズルとが所定の方向に交互に隣接して配置されたノズル列を有する記録ヘッドを用い、前記記録ヘッドと被記録媒体とを相対的に走査させながら、前記インクと前記液体を前記被記録媒体に吐出することで画像を記録するインクジェット記録装置を制御するためのプログラムであって、

記録すべき画像中の少なくとも一部の領域を前記インクのみで記録するか、前記領域を前記インクと前記液体の双方で記録するかを決定する決定工程と、

前記決定工程による決定結果に基づき記録データを生成する生成工程とを含み、

前記領域を前記インクと前記液体の双方で記録すること

0を横一列に配列した場合は示しており、イエロー(Y)・マゼンタ(M)・シアン(C)・ブラック(B)の4色の各ヘッド(90Y・90M・90C・90B)を備えたヘッドユニット9である。また、図2(b)は図1で示した直線配列型記録ヘッド90を縦一列に配列した場合を示しており、これも図2(a)と同様にイエロー(Y)・マゼンタ(M)・シアン(C)・ブラック(B)の4色の各ヘッド(90Y・90M・90C・90B)を備えている。尚、図2(a)及び図2(b)に示すような各ヘッド90は、分離独立しているもよく、また一体化されているもよい。本実施形態においては、このような記録ヘッドユニット9をインクジェット記録装置に搭載している。

【0034】図3は、本発明に係るインクジェット記録装置の概略構成図であり、図2(a)に示す記録ヘッドユニット9を搭載している。イエロー・マゼンタ・シアンの3色を搭載している。イエロー・マゼンタ・シアンの3色を出力するための各ノズルには対応する各インクタンクから各色のインクが供給され、また、クリヤインクを吐出するノズルにはクリヤインクタンクからクリヤインクが供給される。その際、各色のヘッドにおけるインク吐出用ノズルとクリヤインク吐出用ノズルとが交互になるように配置されている。

【0035】図3において、被記録媒体1は搬送ローラ4、5を経て給送ローラ2で保持され、給送ローラ2に連動した副走モータ3の駆動に伴って図中矢印A方向に搬送される。また、被記録媒体1を横切するようにしてガイドルール6、7が平行に設けられており、このガイドルール6、7に沿ってキャリッジ8は案内され、キャリッジ8に搭載された記録ヘッドユニット9が左右に走査される。

【0036】キャリッジ8にはイエロー・マゼンタ、シアン、ブラックの4色の記録ヘッド90Y、90M、90C、90Bが搭載されており、これらそれぞれが記録ヘッド90Bに対して4色のインクタンク12から夫々対応するインクが供給される。また、記録ヘッド90Y、90M、90C、90Bの夫々には、クリヤインクタンク13からクリヤインクが供給される。被記録媒体1は各記録ヘッドの印字幅分もしくは印字幅より小さな量だけ間欠送りされるが、被記録媒体1が停止している時に記録ヘッドはPQ方向に走査し、画像信号に応じたインク滴を吐出して記録が行われる。

【0037】尚、インクジェットプリンタには、被記録媒体を副走させることで記録を行うライン型プリンタと、記録ヘッドの主走査及び被記録媒体の副走査を繰り返しながら記録を行うリアル型プリンタの2種類がある。上記図3はリアル型プリンタの一例であり、ノズル配列方向とは副走査方向(図3のPQ方向)に記録ヘッドを主走査し、主走査分の記録が終了した後、記録ヘッドの幅分もしくはそれより小さな量だけ被記録媒体

をノズル配列方向(図3のA方向)に副走査し、これを繰り返すことで記録を行なっている。また、本発明はこのリアル型プリンタに限られるものではなく、図4に示すようなラインプリンタにも適用可能である。すなわ

ち、ラインプリンタの場合には、ノズルが記録幅だけ図4のように配列しており、各色の記録ヘッド(90Y・90M・90C・90B)を記録媒体のA方向に沿って配列すると共に各色記録ヘッドの夫々に対し記録インク及びクリヤインクを供給する。そして、記録ヘッドの主走査は行わずに、ノズル配列方向と垂直方向(図4のA方向)に被記録媒体を副走査させることで記録を行う。

【0038】上記図3のようなリアル型のインクジェット記録装置では、図5(a)に示すように、複数のノズルを配列させた記録ヘッド90をX方向に走査すると、幅dだけの画像記録を行い、1ラインの記録が終了する毎に記録ヘッド90の記録幅分ずつ、図5(a)に示すY方向と逆方向に被記録媒体を間欠送りするようにしている。この走査を図5に示す(1)、(2)、(3)の順に繰り返すようにして記録が行われる。また、図5(b)に示すように、記録ヘッドの幅より小さな量だけ、Y方向と逆方向に被記録媒体を間欠送りすることに より画像記録を行ってもよい。この場合、記録媒体における同一ライン上を複数回、記録ヘッドが主走査することになる。尚、この図5(b)は被記録媒体を記録ヘッド幅の1/2ずつ副走査させており、被記録媒体の同一ライン上に記録ヘッドが2回主走査することで画像を形成している。例えば、被記録媒体上の領域Bは記録ヘッドの①の主走査と②の主走査により記録され、領域Cは③の走査と④の走査により記録される。

【0039】ここで、本発明に適用可能なインクジェットヘッドについて詳述する。本発明においては、発熱抵抗素子を備えたバブルジェット(壁熱抵抗)ヘッドを用いることが最速である。また、本実施形態において使用するバブルジェットヘッドは、従来の製造方法のプロセスを利用して製造することができ、以下にバブルジェットヘッドの製造方法について示す。バブルジェットヘッドを製造する方法としては、例えばシリコン基板上に発熱素子、発熱素子用配線を薄膜技術を用いて形成し、さらに樹脂である感光性樹脂を用いたフोटオリソグラフィ等の工程により、インク流路の溝壁及び共通インク室壁を形成し、ついで他のガラス等の平板の覆いを接合し、いわゆるバブルジェットヘッドの主要部である吐出エレメントを形成する方法が知られている。この吐出エレメントは、共通インク室入口部にフィルタが装着され、ベースプレート上にPCBともにも固定される。吐出エレメントとPCBとの間の電気的接続はワイヤボンディングなどの方法がとられる。最後にフロントカバー、インク取入れ部材が固定され、液密、気密の目的でシリコーン樹脂等の封止剤が充填される。図6～図8は

上記バブルジェットヘッドの構成を示すものである。【0040】図6は、1色の記録インクを吐出するための吐出エレメントの構成を要約している。シリコン基板301上に発熱素子303と発熱素子用配線302が薄膜技術を用いて形成されており、さらに感光性樹脂等の樹脂により形成されたインク流路の溝壁及び共通インク室壁304がある。その上に共通インク入口部307があいたガラス板305が接着されており、また、ガラス基板305に設けられる共通インク入口部はガラス板に接着されたフィルタ306によって覆われている。

【0041】図7はバブルジェットヘッドの構成を示す概略図である。吐出エレメント401とPCB402とが吐出エレメントを支持する支持体としてのベースプレート403上に接着固定され、両者はワイヤボンディング406によって電気的に接続されている。これによりインク取入れ部材405、及び吐出部407が取り付けられたフロントカバー404を接合させ、液密、気密の目的でシリコーン樹脂501を充填させたものが図8に示されるバブルジェットヘッドである。尚、インクジェットヘッドを形成する別の方法としては、耐インク性のあるプラスチック樹脂の成形により溝を形成して、蓋板と接合しインク流路の形成する方法でもよい。また、インク流路の従来の別の形成方法として、特公平2-42669号にみられるように感光性樹脂の硬化膜を用いて流路形成用の溝を形成した後、蓋板と接合又は圧着してインク流路を形成してもよい。

【0042】本発明に適用可能なバブルジェットヘッドは上述した従来のヘッドの製法を利用して製造するわけであるが、図6に示すような従来のバブルジェットヘッドでは1色の記録インクを吐出するためのヘッドを想定しているもので、当然のことながら流路及び共通室には同一色のインクが充填されている。しかしながら、本発明では1つの記録ヘッドにおけるノズル列から記録インクとクリヤインクの双方を吐出することを特徴としているので、図6に示すようなインク流路の構成では本発明を実現することができない。そこで、本発明においては、流路を図9(a)～(c)示すように構成している。すなわち、複数のノズルから構成されるノズル列に対して記録インクとクリヤインクとを交互に供給するようにしたのである。このように本発明では、記録インクを吐出するためのクリヤインク吐出用ノズルとが交互に配置されたノズル列を有するインクジェットヘッドを用いている。尚、図9は記録インクとクリヤインクをノズル列に交互に供給するための液流路の一例を示す図であり、(a)は透視斜視図、(b)は透視正视图、(c)は側面断面図である。このように本発明に適用可能なインクジェットヘッドは、図1や図9に示されるように記録インク吐出用ノズルが1つおきに配置されたノズル列を有しており、記録インク吐出用ノズルに隣接す

るノズルがクリヤインク吐出用ノズルとなっているヘッドである。

【0043】このようなインクジェットヘッドを用いて記録媒体に画像を記録するに際し、本発明では、記録インク吐出ノズルのみを駆動して被記録媒体に記録インクのみを記録する場合と、記録インク吐出ノズル及びクリヤインク吐出ノズルの双方を駆動して被記録媒体に記録インク及びクリヤインクを記録する場合とを、記録すべき画像に応じて使い分けている。そして、記録インクとクリヤインクを共に記録するときは、図10(a)に示すように、記録ヘッドの同一主走査において記録インク吐出ノズルとそれに隣接する少なくとも1つのクリヤインク吐出ノズルと共に駆動している。記録ヘッドの同一主走査において記録インクとクリヤインクの双方を隣接ノズルから吐出することで、被記録媒体上に記録インクとクリヤインクとを精度よく接合(混和)させることができ、また図10(b)に示すように記録ヘッドによる被記録媒体を広く行うことができる。尚、図10(b)や後述の図14(b)では着弾ドットを中心部分で薄く示されているが、これは単に記録インクとクリヤインクとを混和した様子を示すだけであり、実際には、着弾ドットに図示しているだけであって、実際には、着弾ドットの中心部分が薄いわけではない。また、図10では1200dpiのヘッドを用いている。

【0044】上述(同一主走査において隣接ノズルから吐出された記録インクとクリヤインクとが被記録媒体上で混和すること)からも分かるように、本発明において使用するインクジェットヘッドはノズルが高密度に配列されている。通常、このような高密度ヘッドを用いて記録を行うと、種々のメリットがあると同様にいくつかの弊害もある。この弊害について、図11に示すような1200dpiのヘッドを用いて以下に簡単に説明する。図11は、1200dpiのヘッドであり、全てのノズルから記録インクを吐出することが可能である。この図11に示すヘッドにおける隣接ノズルから記録インクを吐出したとすれば、図11(b)に示されるように被記録媒体上において隣接する記録ドット同士が重なり合ってしまう。単に隣接ドット同士が重なっただけでは問題はないが、その隣接ドット同士が同一主走査中において重なる場合は、その記録ドット同士は液状で混和することになる。このように隣接ドット同士が液状で混和すると、ドットが溶けだしてしまい画像品位が劣化してしまう恐れがある。特に、高解像度が要求される文字や細画等においてはこの溶け込みがとりわけ画像品位に影響を及ぼす。そこで、前述したように従来の記録方式では、先に吐出されたインクが被記録媒体中に浸透するまでの時間をおかせぐために同一走査中において隣接ドットを記録しないようにし、次の走査中において隣接ドットを記録するようにすることで、ドット同士の重なりによる溶け込みを低減させていた。すなわち、同一領域を複数回走査す

このことについて詳述する。記録インクとクリアインクが混和すると、記録インクの色がクリアインクによって拡散され、記録インクドットは薄められる。このようにして記録インクドットが薄められると記録インクドットの光学濃度は低下すると考えられるが、薄められることで記録インクドットの面積が広がるので、単に薄められたからといって光学濃度が低下するわけではない。即ち、記録インクドットの光学濃度は、単位面積あたりの色材の絶対量によってのみ決定されるのではなく、実際には記録媒体上における記録ドットの被覆面積が大きく影響するのである。

【0057】例えば、このことは図15から分かる。図15は、ベタ光学濃度がDsの第1インクとベタ光学濃度がDs/2の第2インクの2種類のインクによるドット被覆率と光学反射濃度(OD値)との関係を示している図である。尚、横軸はドットによる被覆率であり、縦軸はOD値である。この図15から、第1インクによって被覆率50%を実現するよりも第2インクによって被覆率100%を実現した方がOD値が高いことが分かる。(これは、A点のOD値よりもB点のOD値の方が大きいことから明らかである。)すなわち、図15は、濃度1"の記録インクドットで面積1"を形成より濃度1"/2"の記録インクドットで面積2"を形成した方がOD値が高いことを示しているのである。以上のことから、光学反射濃度はインクそのものの濃度のみにによって決定されるものではなく、被覆面積が大きく保たれていることが分かる。

【0058】本発明は、この原理を利用して光学反射濃度の上昇を図っている。記録インクドット1個とクリアインクドット1個とを混和させた場合、混和後のインク濃度は記録インクの濃度に対して平均約1/2であり、混和後のインク被覆面積は記録インクドットのみが被覆面積に対して平均約2倍となる。この場合、下記のYule-Nielsenの式(D: 反射光学濃度、n: 定数、a: ドット被覆率、Ds: ベタの反射光学濃度)から明らかのように、ドット被覆率が上がれば反射光学濃度は高くなり、遠く見える。本発明においては、記録インクドット間にクリアインクドットを打って薄めることによりドット被覆率を上昇させることで、記録インクドットのみによる光学反射濃度よりも高い光学反射濃度を有する画像を記録することを可能としている。

[0059]

[外1]

$$\text{Yule-Nielsen式 } D = n \log \frac{1}{1-a(1-10^{-Ds})}$$

*【0060】上記第1の記録モードでは特に記録速度を重視しており1パス記録を可能としているが、1パスで記録を行うと隣接ドット同士が接しないのでドット間に隙間ができ、その隙間により画像の品位が低下して見え

センサやSW(スイッチ)からなるセンサ/SW部1607からの信号をCPU1602に送る。表示素子コントローラ部1608は、CPU1602からの指令により、表示素子群のLEDや液晶素子等からなる表示素子部1609を制御する。記録ヘッド部1610は、CPU1602からの指令により記録ヘッド90Y、90M、90C、90Bkを制御する。例えば、画像データやユーザの選択に応じて、各ヘッドにおける記録インク吐出用ノズルのみを駆動する場合と、記録インク吐出用ノズル及びクリアインク吐出用ノズルの双方を駆動する場合とを制御し、ノズルを選択的に駆動することで画像を形成する。また、記録ヘッドコントローラ部1610は、上記記録ヘッドの状態を示す温度情報等を出して、それらをCPU1602に伝える。

【0063】図17は、ホストコンピュータ1710の制御系の構成を示すブロック図である。図17において1710はホストコンピュータ、例えばパーソナルコンピュータであり、1700は各部を制御するMPU、1701は各種の動作プログラムを格納した読出し専用メモリROM、1702は書き込み可能なメモリRAMである。1704は画像処理全般を行う画像処理部、1705は画像のベタ領域を後述するベタ領域後出部であり、1707は各種キーの入力及びメッセージの表示等を行うための操作部である。ホストコンピュータ1710は、ROM1701に格納されたプログラムに基づいて動作するMPU1700により制御される。ROM1701には、文書処理プログラム等を制御するアプリケーションプログラム、プリントを駆動するためのプリンタドライバ、アプリケーションプログラムとプリンタドライバを仲介するグラフィックサブシステム等が含まれており、また、本実施形態に係る図19のフローチャートで示す処理を実行するためのプログラムも格納されている。また、ホストコンピュータ1710にはインクジェット記録装置100、センサやデジタリカメラ等の画像入力装置150等がインターフェース部1603を介して接続されている。

【0064】図18は、ベタ領域後出部1705の構成を示すブロック図である。本実施形態では、図17に示したようにベタ領域後出部1705を独立して設けてあるが、例えば、画像処理部1704の内部に設けても良い。以下に本実施形態におけるベタ領域の後出方法について説明する。ここでは、特に、原稿画像をセンサで読み取り、原稿画像における黒ベタ領域を後述する場合について示す。

【0065】黒ベタ領域の後出は、黒画素がどのくらい連続して存在するのかが、いうことに基づいて行われる。具体的には、原稿画像の1ライン中の黒画素の個数をカウントし、その個数が所定のしきい値以上であればそのラインをベタ領域の候補とし、この候補ラインが一

定ライン続いたらその開始ラインから終了ラインまでを黒ベタ領域とする。

【0066】図18は、上記後出方法を用いてベタ領域後出部1705を構成した場合のブロック図であり、コンパレータ201と、DF/F(D型フリップフロップ)202と、インパルスカウンタ203と、コンパレータ204と、ラインカウンタ205と、セレクタ206と、DF/F207と、DF/F208とで構成される。ベタ領域後出部1705では、まず、センサやデジタリカメラ等の画像入力装置から入力される多値画像データをコンパレータ201でThreshold(しきい値)と比較して、対称処理画像用に2値化する。DF/F202は、2値化したデータを入力し、黒画素が所定画素連続したら出力BからHigh出力する。インパルスカウンタ203は、このHigh出力の回数をカウントし、ラインロックに基づいて1ライン辺りの黒画素数を出力する。コンパレータ204は、1ライン辺りの黒画素数をThreshold2(しきい値)と比較して、Threshold2の値以上であれば、この時のY座標をDF/F207でラッチする。この時最初にThreshold2を越えた値をY1とし、その後、ラインカウンタ205、セレクタ206、DF/F207、DF/F208によってY1がLowになるまでY座標の値を更新しYnを待てる。即ち、Y1～Ynの間が黒ベタ領域となる。尚、上記では黒ベタ領域を後述する場合について説明したがこれには限られず、他の色(C・M・Y等)のベタ領域も後述することも可能である。例えば、CインクによるCベタ領域を後述する場合は、C画素に着目することにより後述することができる。

【0067】以上の構成を用いて実現される第1の実施形態の動作について、図19のフローチャートを用いて説明する。図19は、画像データに応じて、記録インクのみを使用する場合(第1の記録モード)と記録インク及びクリアインクの双方を使用する場合(第2の記録モード)とを制御する処理について示しており、MPU1700が各部1701～1705を制御することによりこの処理は実行される。まず、ステップS1において、画像入力装置(センサ)150で原稿を読み取り、画像入力装置(センサ)150で原稿を読み取り、読み取った読取画像データ中におけるベタ領域の後出をベタ領域後出部1705で行う。ベタ領域であればステップ3に進み、そのベタ領域を上記第2の記録モードで記録するように設定する。つまり、ベタ領域と判定された領域は、記録インクとクリアインクの双方を用いて記録するのである。ステップS3で第2の記録モードを設定したら、ステップS4において前記ベタ領域を記録するための記録画像データを作成する。ここで得られたデータをデータAとする。その後、ステップS7に進む。

【0068】一方、ベタ領域でない非ベタ領域であれば

の輪郭線の方向(「2」の方向)から反時計回りに近傍画素を調べ、これが追跡開始画素にたどり着くまで繰り返す。この様な処理を行うことで図20の矢印群で示すような輪郭線が得られる。

【0075】このようにして得られた輪郭線のデータをRAMに格納し、その後、この輪郭線データがベタ領域であるかどうかを判断する。この判断手法としては、輪郭線内の画素数をカウントすることにより行われる。具体的には、まず、X方向において連続する画素数をカウントする。そのX方向にはjN行分行う。例えば、図20

では、j1行目で画素3個、j2行目で画素5個、...と順にカウント(計数)していく。次に、カウント画素数の合計数と予め決められた閾値とを比較し、合計数の方が大きい場合は輪郭線内をベタ領域と判断する。一方、合計数の方が小さい場合は非ベタ領域と判断する。すなわち、このベタ領域の検出では、輪郭線内の画素を予め決められた閾値より大きいかわきり空かベタ領域であるかを否かを判断している。上記と同様に、ベタ領域と判断された場合は第2の記録モードを設定し、非ベタ領域と判断された場合は第1の記録モードを設定する。

【0076】なお、第1の実施形態では、上述のようにベタ領域の検出や記録モードの設定等の各処理はホストコンピュータ1710側で行うこととしているが、プログラムのメモリ部に前記各処理を実行するためのプログラムを格納しておくことによりプリンタ側で前記各処理を行ってもよい。また、第1の実施形態では、この各処理を図17におけるROM1701に格納したプログラムを用いMPPU1700がソフトウエア的に処理を行うようにしているが、この各処理を行うための専用の回路をプリンタ側に設けてハードウエアで構成するようにしてもよい。

【0077】以上のように本実施形態によれば、記録インク吐出用ノズルとクリアインク吐出用ノズルとが交互に配置された高密度ヘッドを用いて画像の記録を行うに際し、解像度が要求されないベタ領域は記録インクとクリアインクの双方で記録するようにし、解像度が要求される非ベタ領域は記録インクのみで記録するようにすることで、記録速度を低下させずにしかも十分な印字速度でベタ領域を形成でき、また高解像度で非ベタ領域を形成できる。従って、本実施形態を用いることで、短時間で解像度の高い画像が記録可能となる。さらに、ヘッドの構成上、同一主走査において吐出される記録インクドット同士は隣接しないので記録インクドットによる滲みを低減でき、また、高解像度をし過ぎているわけではないので吐出インクドットのよれも目立ちにくくすることができ。

【0078】(第2の実施形態) 次に、本発明の第2の実施形態について説明する。この第2の実施形態では、文字領域は第1の記録モードで記録し、輪郭領域(非文字領域)は第2の記録モードで記録することを特徴とする。図20の「4」の方向より反時計回りに追跡を開始する。次に、図21の「4」の方向より反時計回りに追跡を開始する。「4」の方向から反時計回りに近傍の画素を調べ、最初に見つかった画素の方向を輪郭線の方向とする。次いで、追跡中心画素をその画素に移動し、前回の画素がなくなると繰り返して実行する。

【0079】図22は第2の実施形態の処理手順を示すフローチャートであり、この処理を実行するためのプログラムは図17のROM1701に格納されている。また、図22に示すフローチャートはMPPU1710により実行される。

【0079】図22は第2の実施形態の処理手順を示すフローチャートであり、この処理を実行するためのプログラムは図17のROM1701に格納されている。また、図22に示すフローチャートはMPPU1710により実行される。

【0080】まず、ステップS1において、画像入力装置150で原稿が読み取られ、画像が入力される。原稿としては、例えば、文字領域と輪郭領域とが混在した多数の画素を有するグラフィックのようなフルカラー画像であり、画像入力装置150で読み取られたフルカラー画像はデジタルデータに変換され、R・G・Bの多値画像データとしてインターフェース部1703を介してホストコンピュータ1710に入力される。次に、ステップS2において、入力されたR・G・Bの多値画像データは、画像処理部1704で、インクジェット記録装置100で出力可能なY・M・C・Bkの2値データに変換される。その後、ステップS3において、2値化されたY・M・C・Bkデータに対して、文字であるかを否かの文字判定を行う。

【0081】文字である文字領域であればステップS4に進み、その文字領域を第1の記録モードで記録するように設定する。つまり、文字領域と判定された領域は、記録インクのみで記録するのである。ステップS4で第1の記録モードを設定したら、ステップS5において前記文字領域を記録するための記録画像データを作成する。ここで得られたデータをデータCとする。その後、ステップS8に進む。

【0082】一方、文字でない輪郭領域であればステップS6に進み、その輪郭領域を第2の記録モードで記録するように設定する。つまり、輪郭領域と判定された領域は、記録インクとクリアインクの双方を用いて記録するのである。ステップS6で第2の記録モードを設定したら、ステップS7において前記輪郭領域を記録するための記録画像データを作成する。ここで得られたデータをデータDとする。その後、ステップS8に進む。

【0083】ステップS8において、文字領域のデータと輪郭領域のデータとを結合する。具体的には、文字領域を記録するために得られたデータCと、輪郭領域を記録するために得られたデータDとの理論値をとり、これを記録データとする。

【0084】このようにして得られた記録データは、インターフェース部1603を介してインクジェット記録装置100に伝送され、そしてインクジェット記録装置にて記録が行われる。以上により、文字領域を記録インクのみで記録し、輪郭領域を記録インクとクリアインクの双方で記録した記録画像が形成される。

【0085】ここで、図22におけるステップS3の文字判定について説明する。具体的には図23のフローチャートで示すような処理手順で実行される。まず、ステップS1において、カウントLの値を「1」にする。次に、ステップS2において、図24に示すように、注目している色の2値データに対してX方向の射影1次元データを求める。そして、ステップS3において、図25に示すように、その射影1次元データのデータ形状(幅W、間隔B、高さH、鋭さH/dx)を計測する。

【0086】ステップS4において、形状の測定結果である幅W、間隔B、高さH、鋭さH/dxと予め設定された基準値とを比較することにより、文字であるかを判定する。例えば、文字は行をなして印刷されることとほとんどなので、X方向射影データの幅W及び高さHから文字を判定することができる。すなわち、データの幅W及び高さHが略同じであれば、その領域は文字領域と判定する。こうして、文字判定は行われる。なお、文字判定を行うステップS2、S3、S4はこれ以外の方法、例えば、図26で示されるランレングスの頻度分布(図27)を解析することによりおこなってもよい。

【0087】ここで、輪郭領域を記録インクとクリアインクの双方で記録し、文字領域を記録インクのみで記録する理由について説明する。これは、輪郭領域には階調性があり、一方、文字領域には階調性には階調性がないからである。一般に、写真画像等の輪郭領域には階調性があり、階調レベルの異なる多階調データを記録することにより、前記輪郭領域は形成される。従って、輪郭領域を記録する場合には階調表現を行うことが必要である。特に、より高品位な画像を得るためには、表現し得る階調数が多い方が好ましい。よって、本実施形態においては、高階調表現を行うことに適していることから、輪郭領域を記録する場合には記録インクとクリアインクの双方を用いることとしている。一方、文字というのは一定の階調レベルで記録されるものであり、階調表現を必要としない。従って、階調表現を必要としない文字領域を記録する場合には記録インクのみを用いている。記録インクのみで文字を記録した方が鮮明な文字を形成できる。

【0088】上述したように本実施形態では、記録インクとクリアインクの双方を用いることで表現し得る階調数を増加させ、高品位な輪郭領域を形成可能としている。ここで、記録インクのみを用いるよりも、記録インクとクリアインクの双方を用いた方が表現し得る階調数が増加する理由を図28～図33を用いて説明する。

【0089】図28は、記録インクによる記録ドットとクリアインクとを接触させることで記録ドットの配置状態が変化する様子を示した図である。図28において、2801は記録媒体の断面を表しており、2802は記録媒体に着弾した記録ドット、2803は記録ドットと記録媒体とに付与したクリアインクを示している。また、図28(a)は記録媒体に記録ドットのみを記録し

た場合であり、図28(b)は記録ドットを着弾させてから十分な時間が経過した後(T3)に、クリアインクを記録ドットに重ねて記録した場合であり、図28(c)は記録ドットを着弾させてから直ぐ(T2)にクリアインクを重ねて記録した場合である。また、Da、Db、Dcは、矢張り図28(a)、図28(b)、図28(c)の記録条件による記録ドットの光学反射強度を示している。尚、Da、Db、Dcは、記録ドットを着弾させた時間T1及びクリアインクを着弾させた時間T2、T3から十分な時間が経過した後の時間T4において測定している。つまり、クリアインクによる記録ドットの被覆状態の変化が終わってから測定している。

【0090】図28(b)では、記録ドットを着弾させてから十分な時間が経過した後、クリアインクを記録ドットに重ねて記録するので、記録ドットの被覆状態はほとんど変化しない。従って、記録ドットの被覆状態は、図28(a)のように記録ドットのみを着弾させた場合と略同である。一方、図28(c)では、インクが記録媒体内に完全に浸透する前にクリアインクを吐出しているため、クリアインクにより記録ドットが広がる。この場合、光学反射強度は、 $D_a = D_b < D_c$ である。本実施形態では、上記の記録条件により光学反射強度が $D_a = D_b < D_c$ となることを利用している。つまり、記録ドットによる被覆面積の増加に伴い、光学反射強度が増加することを利用しているのである。

【0091】上述のように本実施形態はクリアインクによって記録ドットの被覆面積を増加させているが、本実施形態はこれを利用して、記録ドットの被覆面積を増加させ、これをスームズなグラデーションを表現可能として、これを図29を用いて説明する。

【0092】図29は、ドットマトリクス内に記録ドットとクリアインクドットを配置したドットパターンである。図29(a)のように4×4のドットマトリクス内に4個の記録ドットを印字した場合の光学反射強度をD1、図29(b)のように4個の記録ドットの近傍に4個のクリアインクドットを印字した場合の光学反射強度をD2、図29(c)のように4個の記録ドットの近傍に8個のクリアインクドットを印字した場合の光学反射強度をD3とすると、これらは $D1 < D2 < D3$ の関係になる。これは被覆媒体表面上に着弾(付着)した記録ドットの大きさ、形状、被覆面積の増減、被覆媒体内部への浸透メカニズム等が影響しているものと考えられ、特にドット形状が被覆媒体表面上でヨコゴに広がったり径を拡大することによって被覆効果を向上させる現象が生じて強度を向上させているものと考えられる。

【0093】一般に、図29(a)のようにドットマトリクス内に4個の記録ドットを配置したドットパターン(図29(d)のようにドットマトリクス内に5個の記録ドットを配置している。この図29(d)の光学反射強度

度をD4とすると、当然のことながら光学反射強度の関係は $D1 < D4$ となる。従来は1つの濃度のインクでD1とD4の間の階調を表現することができなかったが、本実施形態では上記D2またはD3がD1とD4の間にあること、即ち光学反射強度の関係が $D1 < D2 < D3 < D4$ であることを利用してD1とD4の間の階調を増加させている。このようにして表現し得る階調数を増やす。また、D1とD4の間の光学反射強度を有する中間調を得るためには、ただ暗雲にクリアインクを加えればよいというものではない。D2とD3の関係から分かれるように着弾させるクリアインクドット数によって光学反射強度が異なるので、記録ドットと接触させるクリアインクの量、つまりクリアインクドット数を制御することによって中間調を表現しなげなければならない。着弾させるクリアインクドット数を変化させることにより所望の階調数を得ることが可能となる。

【0094】記録媒体上における色材を含有する記録ドットの様子を観察すると、記録媒体表面に着弾した記録ドットが真円であることは稀である。通常、例えば、普通紙(PPC用紙)上では紙の繊維に沿って色材が染み込んだり、表面に滲みこんでいるような部分もあり、非常に複雑な形状である。すなわち、記録ドットとは記録媒体表面上では複雑な形状を呈している。このよう複雑な形状を有している記録ドットに隣接する位置に上記クリアインクを付着させると紙面上で記録ドットの形状が変化する。具体的には、色材が紙面の繊維に沿ってより多く染み込むこととなり、ドットの径の拡大が顕著なことになる。また、ドットの境界部分が滑らかにより、ハライイト部における記録ドットの粒状感を低減させるという効果も現れる。

【0095】以上のように本実施形態は、記録ドットとクリアインクドットの双方のドットにより階調表現する場合、記録ドットのみで階調表現するよりも表現し得る階調数を増加させている。例えば、図30・図31に示したように4×4のドットマトリクスを用いて階調値を表現する場合は、通常、図30(a)・図31(a)のごとく16階調値のドットパターンが考えられる。

ところが、記録ドットとクリアインクドットの双方のドットにより階調表現する場合は、例えば、図30(b)・図31(b)のように2.5階調の表現が可能となる。尚、図30(b)・図31(b)は、階調値が“16”以下のドットパターンに対してクリアインクを加えている場合である。このようにハライイト部を記録する際にクリアインクを用いることとすることで、ハライイト部における記録ドットの粒状感が低減される。また、階調数が増加することによってスームズなグラデーションが表現可能となり高品位な画像を得ることができ。

【0096】尚、図1に示すような本発明に係る記録ドットを用いて図30や図31に示すようなドットパ

ターンを記録する場合、記録ドットとクリアインクドット(1パス)では図30や図31に示すドットパターンを記録することはできない。従って、図30や図31に示すようなドットパターンを記録する場合はマルチパス方式を用いて記録を行う。しかしながら、本実施形態においては使用可能なドットパターンは上記図30・図31に限られず、記録ドットとクリアインクドットの配置が図30・図31とは異なるドットパターンを用いてもよいことは言うまでもない。その場合、1パス記録が可能のようにドットが配置されたドットパターンを用いることで、1パス記録が可能となる。

【0097】また、図32・図33に他のドットパターンの例を示す。図32は9階調値のドットパターンを示しており、記録ドットとクリアインクドットの比率が1:1、1:2、2:3、3:4...のように変化している。図33のようは、図32のように常に一定でもいいし、図33のように変化させてもいいが、より多くの階調を表現したい場合は図33のようにしたほうがいい。尚、この図32・図33に示す双方とも、1パス記録可能なドットパターンである。

【0098】このように本実施形態によれば、1画像に対応しているドットマトリクスの大きさを変えずに、すなわち出力解像度を低下させずに階調数を増加させることが可能であり、階調性に優れた絵柄領域を形成できると、記録インクとクリアインクを混合させている場合の弊害、すなわち濃淡インク間の濃度の差が大きいと記録画像における淡インクと濃インクの切り換え部分(つなぎ部分)が目立ってしまい画像品位を低下させるという弊害が生じない。

【0099】上記の本実施形態では、文字領域であるか絵柄領域であるかに応じて、第1または第2の記録モードを設定している。具体的には、文字領域である場合は第1の記録モードを設定し、絵柄領域である場合は第2の記録モードを設定している。このように設定する理由は、上記したように、一般に文字領域には階調性がなく、絵柄領域には階調性があるからである。つまり、この第2の実施形態を別の見方でみると、階調性の有無に応じて、記録モードを設定しているということもでき、従って、この第2の実施形態は、階調性に着目し、その領域が階調性を有するかどうかに応じて、記録モードの設定を行うこととしてもよい。この場合、画像データの階調レベルに着目し、階調レベルが一定の領域は第1の記録モードで記録するようにし、階調レベルに変化がある領域は第2の記録モードで記録するようにする。

具体的には、まず、入力されたRGBの多道画像データにおける画像毎の階調レベルを抽出する。次に、同じ階調レベルの画素がX・Y方向に所定数以上連続しているかどうかを判定する。そして、連続していると判定された場合は、その領域を非階調領域と判定し、記録インクのみで記録するために第1の記録モードを設定する。一方、連続していないと判定された場合は、その領域を階調領域と判定し、記録インクとクリアインクの双方で記録するために第2の記録モードを設定する。このようにすることで、階調性の有無に応じた記録モードの設定が可能となる。尚、階調性がない画像としては、例えば、文字・グラフ・表・ボスター調の画像等が挙げられる。

【0100】なお、第2の実施形態では、上述のように文字領域の抽出や記録モードの設定等の各処理はホストコンピュータ1710側で行うこととしており、プリンタのメモリ部に前記各処理を実行するためのプログラムを格納しておくことによりプリンタ側で前記各処理を行ってもよい。また、第2の実施形態では、この各処理を図17におけるROM1701に格納したプログラムによりMPU1700がソフトウェア的に処理を行うようにしている。この各処理を行うための専用の回路をプリンタ側に設けてハードウェアで構成するようにしてもよい。

【0101】また、第2の実施形態に係る図22のプロセッサでは、入力された画像データ(文字領域か絵柄領域)に応じて、ホストコンピュータが自動的に第1の記録モードと第2の記録モードとを設定しているがこれに限定されるものではない。すなわち、第1の記録モードと第2の記録モードの設定をユーザーが行ってもよい。この場合、インクジェット記録装置にスイッチやパネルを設け、それによりモードの設定を行うことが考えられる。もしくは、ホストコンピュータ内で処理するプリンタドライバでユーザーが設定を行ってもよい。このようにユーザーが設定する場合は、ユーザーの用途や好みに合わせて画像を出力できるという利点がある。

【0102】なお、上記では文字領域と絵柄領域とが混在した画像を記録する場合を示したが、本実施形態はこれに限定されることなく、文字のみの画像や絵柄のみの画像を記録する場合にも当然適用できる。

【0103】以上のように本実施形態によれば、記録インクとクリアインクの双方で記録するようにし、階調性が要求されない文字領域は記録インクのみで記録するようにすることで、階調性に優れた絵柄領域を形成でき、また一定の階調レベルを示す鮮明な文字を形成でき

る。従って、本実施形態を用いることで、絵柄領域と文字領域とが混在した画像を記録する場合作でも、階調性に優れた絵柄領域と鮮明な文字とを有する高品位な画像が記録可能となる。

【0104】第3の実施形態に上述した第1の実施形態及び第2の実施形態では、第1の記録モードまたは第2の記録モードのどちらか一方を設定することで1パスで記録を行っている。上記第1の実施形態及び第2の実施形態によれば、短時間で十分高品位な画像を形成できるところから1パス記録で十分な場合が多いと考えられる。しかしながら、ユーザの用途や好みもしくは記録すべき画像によっては、記録時間が長くなったとしてもより高品位な画像を形成する方が好ましい場合もある。このような場合は、マルチパス方式で記録を行うことが好ましい。すなわち、第3の記録モード及び第4の記録モードを設定して記録を行うのである。尚、第3の記録モードが設定されるとその所定領域は記録インクのみで且つ複数の回の走査で記録され、第4の記録モードが設定されるとその所定領域は記録インクとクリアインクの双方で且つ複数の回の走査で記録される。この第3の記録モード及び第4の記録モードの設定は、ユーザがインクジェット記録装置に備えられたスイッチやパネルにより設定してもよいし、ホストコンピュータ内や処理するプリンタドライバで設定してもよい。また、第1の実施形態や第2の実施形態と同様に、画像データに応じて、ホストコンピュータまたはインクジェット記録装置が自動的に設定してもよい。この場合、第3の記録モードが第4の記録モードのどちらか一方を常に設定するようにしておいてもよいし、第1、第2、第3または第4の記録モードのいずれか一つを画像データに応じて設定するようにしておいてもよい。

【0105】以上のように本実施形態によれば、マルチパス方式で記録を行う第3の記録モードまたは第4の記録モードを用いることで、第1の実施形態や第2の実施形態よりも記録時間が長くなってしまうが、その代わり第1の実施形態や第2の実施形態よりも高品位な画像の形成が可能となる。

【0106】第4の実施形態に、本発明の第4の実施形態について説明する。この第4の実施形態では、ユーザの用途や好み等に応じて、記録しようとする画像の種類モード（文書・写真、混在画像等）や画像品位・記録時間（高品位モード・高速モード）等をユーザが自ら選択し、その選択結果に応じて第1、第2、第3または第4の記録モードが設定されることを特徴とする。【0107】図34は第4の実施形態を示すフローチャートであり、この図34を用いて本実施形態を説明する。尚、ここでは、画像の種類が文書・写真・混在画像（文字、イラスト、表、写真等が混在した画像）の3種類の場合は例に挙げ説明する。

【0108】まず、ステップS1において、文書・写真

録を行う。また、非文字部を重視する場合はステップS14に進み、第2の記録モードを設定する。すなわち、文字部と非文字部が混在する混在画像を短時間で記録する場合において、特に非文字部の品位を重視するときは記録インクとクリアインクの双方を用いて1パスで記録を行う。

【0112】上記ステップS3、S4、S6、S7、S10、S11、S13、S14の矢矢において記録モードを設定した後はステップS15に進み、画像データを作成する。そして、その画像データに基づいた記録アイコンジェット記号装置に行われる。

【0113】以上のように本実施形態によれば、画像品位、記録時間等をユーザが選択することができるので、ユーザの要求にあった画像記録を行うことができる。

【0114】第5の実施形態に、本発明の第5の実施形態について説明する。この第5の実施形態では、記録インク吐出用ノズルからの吐出量がクリアインク吐出用ノズルからの吐出量より少ないことを特徴としている。以下に図48～図50を用いて、本実施形態について説明する。尚、図48は、本実施形態で適用可能な記録ヘッドの概略構成図であり、(a)は相対的に径が小さい記録インク吐出用ノズルと相対的に径が大きいクリアインク吐出用ノズルが直線的に配列された記録ヘッド（直線配列型記録ヘッド）であり、(b)はこれらのノズルが千鳥状に配列された記録ヘッド（千鳥配列型記録ヘッド）である。図49は、図48に示した記録ヘッド90を複数個備した記録ヘッドユニット9の構成を示す図であり、(a)は図48で示した直線配列型記録ヘッド90を横一列に配列した場合を示しており、(b)は図48で示した直線配列型記録ヘッド90を縦一列に配列した場合を示している。図50は、記録インクのみを用いた記録モード（(a)及び(b)）、記録インク及びクリアインクの双方を用いる記録モード（(c)及び(d)）を示している図である。詳しくは、(a)は相対的に径の小さい記録インク吐出用ノズルのみを駆動することを示しており、(b)は被記録媒体上に着弾した記録インクドットを示している。また、(c)は相対的に径の大きい記録インク吐出用ノズルと相対的に径の大きいクリアインク吐出用ノズルと共に駆動すること

を示しており、(d)は被記録媒体上に着弾した記録インクドットとクリアインクドットが接合してその双方のドットが混在する様子を示している。

【0115】本実施形態では、図48に示すように記録インク吐出用ノズルとクリアインク吐出用ノズルとの径の差が小さく、その結果、正確な階調表現を行いくるからである。このように、本実施形態では、クリアインクの吐出量を V_1 、記録インクの吐出量を V_2 としたとき、 $0.5V_1 \leq V_2 \leq 0.8V_1$ を満たすように制御している。

【0116】また、上記では記録インク吐出用ノズルとクリアインク吐出用ノズルのノズル径の大きさを相対的に異ならせることで両者の吐出量を異ならせているが、本実施形態はこれには限られず、ノズル径を異ならせることなく、単に両者の吐出量を異ならせる構成としても良い。吐出量を異ならせる方法としては、例えば、吐出ノズルに印加する駆動パルスのパルス幅・駆動電圧等を変化させたことにより実現される。そして、本実施形態では、記録インクの1滴あたりの吐出量がクリアインクの1滴あたりの吐出量より少なくなないようにしている。具体的には、クリアインクの吐出量を V_1 とする

と、記録インクの吐出量 V_2 が $V_2 \leq 0.8V_1$ となるように制御している。 $V_2 \leq 0.8V_1$ としているのは、上に述べたようにドット径のバラツキが数%程度あるためである。一方、 $V_2 \geq 0.5V_1$ としているのは、これに制御している。0.5 $V_1 \leq V_2$ としているのは、これに上記録インクの吐出量をクリアインクの吐出量より少なくしてしまくと、記録インクドットに比べクリアインクドットが大きくなり過ぎるからである。このように、正確な階調表現を行いくるからである。このように、本実施形態では、クリアインクの吐出量を V_1 、記録インクの吐出量を V_2 としたとき、 $0.5V_1 \leq V_2 \leq 0.8V_1$ を満たすように制御している。

【0117】尚、本実施形態における記録インク吐出

ノズルからの1滴あたりの吐出量とクリアインク吐出用ノズルからの吐出量の和と、第1の実施形態における記録インク吐出用ノズルからの1滴あたりの吐出量とクリアインク吐出用ノズルからの1滴あたりの吐出量の和とが略同じになるように、本実施形態における記録インク吐出用ノズルのノズル径とクリアインク吐出用ノズルのノズル径とは設定されている。例えば、第1の実施形態での記録インクの吐出量、クリアインクの吐出量を共にXとすると、本実施形態ではクリアインクの吐出量が0.8X、記録インクの吐出量が1.2Xとなるように、記録インク吐出用ノズルのノズル径とクリアインク吐出用ノズルのノズル径が設定されている。

【0118】以上のような本実施形態によれば記録インクが小滴化するため、記録インクのみで記録を行う領域においては第1の実施形態に比べてより高解像度の画像記録を行うことが可能になる。また、ベタ領域を1パスで記録する場合、記録インクとクリアインクを混和させているため、記録インクのみで記録するよりも濃度を高めることができる。

【0119】第6の実施形態1次に、本発明の第6実施形態について説明する。この第6の実施形態では、クリアインク吐出用ノズルからの吐出量が記録インク吐出用ノズルからの吐出量よりも少ないことを特徴としている。以下に図51～図53を用いて、本実施形態について説明する。尚、図51は、本実施形態で適用可能な記録ヘッドの構成図であり、(a)は相対的に径が小さいクリアインク吐出用ノズルと相対的に径が大きい記録インク吐出用ノズルが直線的に配列された記録ヘッド(直線配列型記録ヘッド)であり、(b)はこれらのノズルが半偏状に配列された記録ヘッド(半偏配列型記録ヘッド)である。図52は、図51に示した記録ヘッド90を複数個具備した記録ヘッドユニット9の構成を示す図であり、(a)は図51で示した直線配列型記録ヘッド90を横一列に配列した場合を示しており、(b)は図51で示した直線配列型記録ヘッド90を縦一列に配列した場合を示している。図53は、記録インクのみを用いる記録モード((a)及び(b))、記録インク及びクリアインクの双方を用いる記録モード((c)及び(d))を示している図である。詳しくは、(a)は相対的に径の大きい記録インク吐出用ノズルのみを駆動することを示しており、(b)は被記録媒体上に着弾した記録インクドットを示している。また、(c)は相対的に径が小さいクリアインク吐出用ノズルと相対的に径の大きい記録インク吐出用ノズルとを共に駆動すること

を示しており、(d)は被記録媒体上に着弾した記録インクドットとクリアインクドットが接触してその双方のドットが混和する様子を示している。

【0120】本実施形態では、図51に示すようにクリアインク吐出用ノズルのノズル径が記録インク吐出用ノズルのノズル径よりも相対的に小さくなるように構成す

ノズルからの1滴あたりの吐出量とクリアインク吐出用ノズルからの1滴あたりの吐出量の和と、第1の実施形態における記録インク吐出用ノズルからの1滴あたりの吐出量とクリアインク吐出用ノズルからの1滴あたりの吐出量の和とが略同じになるように、本実施形態における記録インク吐出用ノズルのノズル径とクリアインク吐出用ノズルのノズル径とは設定されている。例えば、第1の実施形態での記録インクの吐出量、クリアインクの吐出量を共にXとすると、本実施形態ではクリアインクの吐出量が0.8X、記録インクの吐出量が1.2Xとなるように、記録インク吐出用ノズルのノズル径とクリアインク吐出用ノズルのノズル径が設定されている。

【0123】以上のような本実施形態によれば記録インクが小滴化するため、第1の実施形態に比べてより高解像度の画像記録を行うことが可能になる。

【0124】第7の実施形態1次に、本発明の第7実施形態について説明する。この第7の実施形態では、走査と走査の間のつなぎ目部分で発生する濃度ムラ(つなぎスジ)を低減させるために、つなぎ目部分あるいはその周辺部にクリアインクを吐出することを特徴とする。以下、図54～図59を用いて本実施形態について説明する。

【0125】まず、本実施形態を説明する前に従来例について説明する。図54は、従来の記録方法を用いて2回の走査により画像を記録した場合を示している。

(a)は記録ドットが正規位置に着弾した様子を示しており、走査と走査の間のつなぎ部分においてスジムラ等の画像欠陥は発生しておらず、全体的にも濃度ムラの無い様な画像となっている。この(a)のように正規位置にドットを着弾させることが理想的ではあるが、実際には、吐出れが生じたり紙送り精度が不十分であったりするため、インクの着弾位置がばらつく。図54の(b)・(c)は着弾位置のバラツキのためにつなぎ部分において画像欠陥が発生した様子を示している。

(b)ではm回目の走査とm+1回目の走査によるつなぎ部分において隣接するドットが必要以上に重なり、そのつなぎ部分において黒スジが発生している。一方、(c)ではm回目の走査とm+1回目の走査によるつなぎ部分において隣接ドット間の距離が必要以上に開いてしまい、そのつなぎ部分において白スジが発生している。このように従来の記録方法では、走査間のつなぎ部分において黒スジや白スジが発生する場合があった。

【0126】そこで本実施形態では、図55に示すように走査と走査の間のつなぎ部分においてクリアインクを吐出して、図55の(A)は、インクが着弾した場合がなく、正規位置(目標位置)にインクが着弾した場合を示している。ここでは、m回目の走査においてn+1と、m+1回目の走査において1番目のクリアインクノズルから吐出されたクリアドットと、m+1回目の走査において1番目のクリアインクノズルから吐出されたクリアドットとが互いに重なり合う

ようにしている。(A)の(a-3)は、このように記録インク及びクリアインクが目標位置に着弾することにより記録された画像である。この場合、目標着弾位置に記録インクもクリアインクも着弾しているのでスジムラの画像欠陥が生じることはない。

【0127】図55の(B)は、m回目の走査とm+1回目の走査のつなぎ部分において、m回目の走査において吐出された記録インク及びクリアインクとm+1回目の走査において吐出された記録インク及びクリアインクとが互いに寄り合い、このつなぎ部分において必要以上に記録インク及びクリアインクが重なり合っている場合を示している。ここでは、m+1回目の走査において1番目のクリアインクノズルから吐出されたクリアインクドットが、m回目の走査においてn+1番目のクリアインクノズルから吐出されたクリアドットと重なるだけでなく、m回目の走査においてn番目の記録インクノズルから吐出された記録インクドットとも重なり合っている。(B)の(b-3)は、このように記録インク及びクリアインクが重なり合っている場合を示している。このように記録インク及びクリアインクが重なり合っている場合、つなぎ部分において必要以上に重なり合っている場合、本実施形態では図55の(B)のよう

に記録インクドット間にクリアインクを着弾させることで、記録インクの濃度を低下させているので、記録インクドット同士が近づくことによる濃度ムラの発生を抑制することができる。

【0128】図55の(C)は、m回目の走査とm+1回目の走査のつなぎ部分において、m回目の走査において吐出されたクリアインクとm+1回目の走査において吐出されたクリアインクとが重なり合わない場合を示している。具体的には、m+1回目の走査において1番目のクリアインクノズルから吐出されたクリアインクドットとm回目のクリアインクノズルから吐出されたクリアドットとが重ならない。また、m+1回目の走査において1番目の記録インクノズルから吐出された記録インクドットとm回目の走査に

おいてn番目の記録インクノズルから吐出された記録インクドットの距離も、規定の距離より長くなり記録インクドット同士が隣接してしまう。このような場合、従来ではこの部分においてドット間に隙間が生じることにより白スジ等の濃度ムラが発生させていたが、本実施形態では図55の(C)のように記録インクドット間にクリアインクを着弾させることにより、記録インクをクリアインクにより覆うことで、記録インクドットのドットの拡大を図っている。このように、記録インクドット同士が隣接していたとしてもドット間に隙間が生じにくく、濃度ムラの発生を抑制す

ることができる。

【0129】次に、本実施形態の記録方法を用いて1バス記録を行う場合と2バス記録を行う場合について説明する。図58は各走査によるつなぎ部分以外の領域に対して記録ヘッドを1回だけ相対走査させることにより画像の記録を行う1バス記録に關して説明するための図である。図57は各走査によるつなぎ部分以外の領域に対して記録ノズルを2回相対走査させることにより画像の記録を行う2バス記録に關して説明するための図である。図58に示すように1バス記録の場合、記録ヘッドが1回主走査する毎に、記録媒体は主走査方向と略直交する方向に第1の量だけ副走査する。第1の量は、記録ヘッドの両端に位置するクリアインクノズル(1番目のクリアインクノズルと $n+1$ 番目のクリアインクノズル)の各吐出口の中心間の距離と同じである。つまり、記録ヘッドが1回主走査する度に図中の $d1$ の量だけクリアインクノズルが走査した領域とその次の主走査に於いて1番目のクリアインクノズルが走査する領域とが同じになるようにするためである。言い換えれば、記録ヘッドの一方の端部のクリアインクノズルと他方の端部のクリアインクノズルとを前後する主走査において同じ領域を走査させるために副走査量を図中の $d1$ のように設定しているのである。このように副走査量を $d1$ とすることで、つなぎ部分においてクリアインク同士をオーバーラップさせることができ、1バス記録においてもつなぎ部分の濃度ムラの低減を図ることができ、また、2バス記録の場合、図57に示すように記録ヘッドが1回主走査した後、記録媒体は第2の量($d2$)だけ副走査し、その後再びヘッドが主走査した後に、今度は第3の量($d1-d2$)だけ副走査する。これを繰り返すことで画像記録を行っていく。尚、 $d2$ とは、隣接するインクノズルとクリアインクノズルの各吐出口の中心間距離のことである。つまり、ここでは1ノズル分だけ記録媒体を副走査させているのである。副走査量を上記のように設定することで、つなぎ部分以外の領域は記録インクノズルとクリアインクノズルが1回ずつ走査されることになり、その結果、画像全体濃度を高めることができるようになる。また、つなぎ部分においても記録インクとクリアインクとをオーバーラップさせることができるので、つなぎ部分で濃度ムラの低減を図ることが可能となる。尚、上記では、1ノズル分だけ副走査させているがこれに限らず、数ノズル分副走査させても良い。また、本実施形態では、1バス記録及び2バス記録に限定されるものではなく、3バス、4バス、4バス…等複数バス記録を行うこともできる。

*【0130】以上のように本実施形態によれば、各走査によるつなぎ部分あるいはその周辺部分にはクリアインクを吐出するように制御することで、つなぎ部に発生しやすい濃度ムラを低減することが可能となる。

【0131】[第8の実施形態]本実施形態では、高解像度が必要な画像のエッジ部を記録する場合には記録インクのみで画像記録を行い、解像度が不要な画像のエッジ部もしくはベタ領域を記録する場合には記録インク及びクリアインクの双方で画像記録を行うことを特徴としている。

【0132】まず、記録インクのみを用いる第1の記録モードに關し、図13を用いて説明する。この第1の記録モードは、文字や細線等の高解像度が要求される画像とで、図13に示すように、被記録媒体上には記録ドットのみが形成される。この記録ドットのみで構成される画像は、隣接ドット同士が重なる確率は低いのでドットの滲みやよれの影響が少なく、また高解像度でもあることが独立した状態で存在しエッジが強調されるので効果的である。

【0133】次に、記録インク及びクリアインクの双方を用いる第2の記録モードに關し、図10と図14を用いて説明する。この第2の記録モードは、特に、解像度が不要な画像のベタ領域や粗雑性のない(結構レベルな一定である)非エッジ部を記録する場合に有効である。上記第2の記録モードでベタ領域や非エッジ部を記録する場合に、図10(a)及び図14(a)のヘッドにおける全てのノズルを駆動することで実現される。そして、吐出される記録インクとクリアインクとを液状混和させるために、記録インクとクリアインクとを記録ヘッドの同一主走査で吐出することが好ましい。このように被記録媒体上で記録インクとクリアインクとを液状で混和させることで、記録インクドットがクリアインクにより広げられ記録インクドットの被覆面積が大きくなる。このことで、短時間でベタ領域や非エッジ部を記録することが可能となる。

【0134】ここで、ベタ領域や非エッジ部を記録する場合に記録インクとクリアインクを混和させることが有効である理由を説明する。まず、第1に、記録時間が短縮できるからである。上述のように、本実施形態では記録ヘッドの1回の走査では被記録媒体における所定領域を記録インクドットで完全に被覆することはできない。つまり、1回の主走査(1バス)では記録インクドット間に隙間が空いてしまい、ベタ領域や非エッジ部を記録できないのである。仮に、本実施形態のヘッドを用いて記録ドットのみでベタ領域や非エッジ部を記録しようとすると、マルチバス方式で記録しなければならず、記録時間が長くなっていく。そこで、記録インクとクリアインクを混和させて記録インクの被覆面積を大きくすることで、記録ヘッドの1回の主走査でベタ領域や

非エッジ部を記録できるようにしている。第2に、記録濃度を高くすることができるからである。本実施形態のヘッドを用いて記録インクドットのみでベタ領域や非エッジ部を記録しようとする場合、記録ヘッドの1回の走査では隣接ドット間に隙間ができてしまい記録濃度が低くなっていく。そこで、記録インクとクリアインクを混和させて記録インクの被覆面積を大きくすることで、記録濃度の上昇を図っている。以上のように、本実施形態では、十分な記録濃度を有するベタ領域や非エッジ部を短時間で記録するために、記録インクとクリアインクとを混和させているのである。

【0135】なお、上記第1の記録モードでは特に記録濃度を重視しており1バス記録を可能としているが、1バスで記録を行うと隣接ドット同士が接しないのでドット間に隙間ができ、その隙間により画像の品位が低下し見える場合もある。そこで、より品位の高い画像を記録したい場合には、第1の記録モードにマルチバス方式を適用した記録方式を用いて記録を行えばよい。具体的には、まず、第1の記録モードと同様に、1バス目で記録インクのみを吐出して隣接ドットが接しない画像を形成する。次に、被記録媒体を副走査方向に搬送した後、2バス目において1バス目で記録したドットの間を補完するように記録インクのみを吐出していくのである。このようにすることでドット間に隙間のない高解像度の画像を記録することが可能となり、第1の記録モードで記録するよりも高画質を図ることができ、このマルチバス方式を適用した記録方式を第3の記録モードとする。尚、この第3の記録モードを適用すると、第1の記録モードよりも高画質でできる反面、記録速度の低下を招いてしまう。例えば、バス数を2回にすれば記録時間は2倍以上、3回にすれば3倍以上かかってしまう。以上のように第1の記録モードと第3の記録モードには失点があるため、これを考慮して記録速度を重視する場合と記録品位を重視する場合とで使い分けられよう。また、第2の記録モードにマルチバス方式を適用した記録方式を第4の記録モードとする。第4の記録モードは第3の記録モードと共に用いられる。双方のモードともマルチバスであり、これによりバス数を合わせることができである。尚、第4の記録モードで記録を行うときであっても、隣接ノズルから吐出される記録インクとクリアインクは記録ヘッドの同一主走査で吐出される。

【0136】このように本実施形態では第1の記録モード、第2の記録モード、第3の記録モード、第4の記録モードにより記録を行うことが可能である。そして、画像のエッジ部を記録するか非エッジ部を記録するかに応じて、記録インクのみを用いる第1の記録モード(もしくは第3のモード)を設定するか、記録インクとクリアインクの双方を用いる第2の記録モード(もしくは第4のモード)を設定するかが決定される。また、1バスで

記録を行う(すなわち、第1の記録モードと第2のモードを用いる)か、マルチバス記録を行う(すなわち、第3の記録モードと第4のモードを用いる)かは、ユーザの選択に応じて決定することが好ましい。

【0137】本発明に係る第8実施形態では、解像度が要求されるエッジ部に対しては第1の記録モードを用い、解像度が不要な画像の非エッジ部に対しては第2の記録モードを用いて行うことを特徴としている。これについて図58～図63を用いて説明する。

【0138】まず、第8の実施形態に係るインクジェット記録装置の各部の制御を執行するための制御構成について、図58に示すブロック図を参照して説明する。制御回路を示す同図において、2010は記録信号を入力するインターフェース、2011はMPU、2012はMPU11が実行する制御プログラムを格納するプログラマROM、2013は各種データ(上記記録信号やヘッドに供給される記録データ等)を保存しておくダイナミック型のRAMであり、印字ドット数や、インク記録ヘッドの交換回数等も記憶できる。2014は記録ヘッド900に接続する記録データの供給制御を行うゲートドライバであり、インタフェース2010、MPU2011、RAM2013間のデータの転送制御も行う。7004はエッジ検出手段であり、画像におけるエッジ部を検出する。2020は記録ヘッド900を搬送するためのキャリアモータ、2019は記録用低搬送のための搬送モータである。2015はヘッドを駆動するヘッドドライブ、2016、2017は夫々搬送モータ2019、キャリアモータ2020を駆動するモータドライバである。

【0139】図59は、図58の各部の詳細を示す回路図である。ゲートドライバ2014は、データラッチ2141、セグメント(SEG)シフトレジスタ2142、マルチプレクサ(MPX)2143、コモン(COM)マルチプレクサ2144、デコード2145を有するタイミング発生回路2144、デコード2145を有する記録ヘッド900は、ダイオードマトリクス構成を採っており、コモン信号COMとセグメント信号SEGが一致したところの吐出用ヒータ(H1からH64)に駆動電流が流れ、これによりインクが加熱され吐出される。

【0140】上記デコード2145は、上記コモンタイミング発生回路2144が発生したタイミングをデコードして、コモン信号COM1～8のいずれか1つを選択する。データラッチ2141はRAM2013から読み出された記録データを8ビット単位でラッチし、この記録データをマルチプレクサ2143はセグメントシフトレジスタ2142に送り、セグメント信号SEG1～8として出力する。マルチプレクサ2143からの出力は、1ビット単位、2ビット単位、または8ビット単位など、シフトレジスタ2142の内容によって種々変更することができ、

を取ったデータを展開する。この時、パツファ4上に残った画面データが非記録画面の周囲2画面内に記録画面が存在するエッジ部となる。更に作業用パツファ5を用意し、該パツファ5上に前記記録画面データであるプリントパツファと前記エッジ部のデータであるパツファ4の論理差を取ったデータを展開する。

【0147】上記の説明では方式の理解を容易とするために作業用パツファを5本使用する場合作について説明したが、1本のパツファ上で全てを処理する方式であっても勿論良い。

【0148】1本の単位となる縦横のドットサイズ(ピットマップサイズ)としては、境界検出のために検出するドット数(本実施形態では周囲2画面であるので5×5画面サイズ)以上であれば制限はないが、横は記録サイズの1行相当分、縦はヘッドのノズル相当分にするこ

とが容易である場合が多い。

【0149】更に論理和や論理積はCPUの機能を利用して、ハードロジックで処理する方式であっても良い。ハード的な処理の場合には縦横同時に膨らみますこと

も可能であり高速処理が達成できる。また、ビット単位処理でもビット単位、或いはワード単位処理でも良い

処理で、大きな単位で処理する方が高速処理が可能であること

とはいうまでもない。

【0150】ドットの拡張の仕方では、例えば左右に2ドット膨らませる手段として前記では左右の2ドット画面の論理和を取ったが、片方向、例えば右方向に8画面分のドットを拡張し(注目ドットから右方向にn画面分論理和を与え)、展開元パツファがX方向にn画面分のデータエリアであったとすると展開先である作業パツファは右方向に8画面分大きなn+8画面分のデータエリアとなるが、該エリア中X方向の端部の4画面分のエリアは捨て、X方向第5画面の位置から第(n+4)画面の位置のデータを抽出することで左右4画面の論理和を取ったと同様のデータが得られる。ソフト上のアルゴリズムやハードロジック構成によってはアドレスを前後に参照するよりも前参照後参照だけに限定できた方が容易である場合があるが、この様な時に該手段は有効である。

【0151】このようにして画像のエッジ部を抽出すること、記録すべき画像をエッジ部と非エッジ部とに分けることができる。この分離後、エッジ部を記録インクのみで記録するように設定し、非エッジ部を記録インクとクリアインクの双方で記録するように設定すること、本実施形態は実現される。また、本実施形態においては、図61に示すようにエッジ部と隣接する非エッジ部におけるドットを記録しないようにしている。すなわち、エッジ部と非エッジ部の間を1ドット分空けること、エッジ部を形成しているものである。このように1ドット分の隙間を空けることで、エッジ部のドットが独立することとなり、画像のエッジ部がより強調されるのである。ま

た、1ドット分の隙間を空けることで、エッジ部分のドットと非エッジ部分のドットとが混じり合っており、シャープに形成できる。尚、図61に示されるように、エッジ部と非エッジ部との間に1ドット分の隙間を設けることで、本来記録すべきドットを間引くこととなるが、これによりエッジが強調され画像品位が向上するので問題ない。一方、図62のようにエッジ部と非エッジ部を区別せず、両方の部分とも記録インクとクリアインクの双方で記録してしまうとエッジが強調されない。尚、上記図61はエッジ部を記録インクのみで記録し、非エッジ部を記録インクとクリアインクの双方で記録した場合の図を示しており、上記図62はエッジ部も非エッジ部も記録インクとクリアインクの双方で記録した場合の図を示している。そして、図61、図62は、主走査位置X1、X2、X3、X4の夫々の位置において記録インクもしくは記録インクとクリアインクを吐出していることを示している。

【0152】ここで、図10に示すような1200dpiのヘッドを用いて、画像記録を行う場合について説明する。図63は、インクジェット記録装置の画像データ処理を示すブロック図である。図63に示すように、まずプリントパツファ7000に格納された画像データを、上記エッジ検出手段7004により、エッジ部データのエッジ部データプリントパツファ7005への格納と、非エッジ部データの非エッジ部データプリントパツファ7001への格納とを行う。尚、本実施形態の場合、非エッジ部データプリントパツファ7001は128ラスタ分のデータを格納できる容量を持っており、一方、エッジ部データプリントパツファ7005は64ラスタ分のデータを格納できる容量を持っている。

【0153】次に、非エッジ部データ処理部7002において、非エッジ部データを記録インクとクリアインクの双方で記録できるように、前記非エッジ部データに対して処理を施す。具体的には、記録すべき記録インクドットに隣接する位置に必ずクリアインクドットが形成されるように、非エッジ部データを処理を施す。つまり、非エッジ部データの半分を記録インクで記録するようにし、残り半分をクリアインクで記録するようにする。さらに、エッジ部と非エッジ部との間に1ドット分の隙間を空けるために、非エッジ部データの最も外側の1ドット分に相当するデータを消去する。このようにして、非エッジ部を形成するドットのうちエッジ部と隣接する1ドット分が記録されないことになる。【0154】また、エッジ部データ処理部7006において、前記エッジ部データを記録インクのみで記録できるように、エッジ部データに対して処理を施す。具体的には、記録すべき記録インクドットに隣接する位置にクリアインクドットが形成されないように、エッジ部データに処理を施すのである。

【0155】このように処理が施されたエッジ部データと非エッジ部データの論理和を取ったデータを転送データ(記録データ)として記録ヘッドに転送する。そして、この記録データに基づいて1パスで画像を形成する。

【0156】尚、上記の説明では、エッジ部と非エッジ部との間を1ドット分空けることとしているが、本実施形態におけるエッジ強調はこの方法に限定されるものではない。例えば、非エッジ部におけるドットのうち、エッジ部と隣接するドットを所定数だけ間引くようにしてもよい。このようにすることで、エッジ部と非エッジ部との境界における画みを低減することができる。また、エッジ部と隣接する非エッジ部におけるドットを全く間引かないようにしてもエッジ部を強調することはできる。但し、エッジ部と非エッジ部との境界の画みをより低減させることによりシャープなエッジ部を形成するという観点からすれば、エッジ部と非エッジ部との間を1ドット分空ける方法、エッジ部と隣接する非エッジ部におけるドットを所定数だけ間引く方法、エッジ部と隣接する非エッジ部におけるドットを全く間引かない方法の順に好ましい。

【0157】尚、上記の説明では画像データのエッジ部検出手段を記録装置で行っているが、画像データを送るホスト側で画像データとエッジ部データを記録装置に送るシステムとすることは可能である。この場合、画像データをプリントパツファに展開しエッジ部データを直接エッジ部データプリントパツファに展開することにより記録装置本体がエッジ部検出手段を用いなくとも上述した実施形態と同様の記録方法及び効果を得ることが可能である。

【0158】以上のように本実施形態によれば、記録インク吐出用ノズルとクリアインク吐出用ノズルとが交互に配置された高密度ヘッドを用いて画像の記録を行うに際し、エッジ部を記録インクのみで記録するようにし、非エッジ部を記録インクとクリアインクの双方で記録するようにすることで、エッジ部を強調することが可能となり、また記録速度を低下させずにしかも十分な印刷精度で非エッジ部を形成することができる。従って、本実施形態を用いることで、鮮明なエッジ部を有する高品位な画像を短時間で記録することが可能となる。また、エッジ部と隣接する非エッジ部におけるドットを記録しないことにより効果的なエッジ強調を行うことができる。

【0159】(第9の実施形態) 次に、本発明の第9の実施形態について説明する。この第9の実施形態では、文字領域におけるエッジ部は第1の記録モードで記録し、文字領域における非エッジ部は第2の記録モードで記録し、絵柄領域(非文字領域)も第2の記録モードで記録することとを特徴とする。ここでは、特に、文字領域と絵柄領域とが混在した画像を記録する場合を例にとりて説明する。尚、本実施形態を説明するために図17、図18、図64を用いる。

いはそれ以上を用意するとしても、このクリアインクは一種類を用意するだけよく、各色で濃淡インクを用意するよりも効果的に階調表現することができる。

【0173】また、上記実施形態ではインク吐出ノズルとクリアインク吐出ノズルとが1ノズル毎に交互に配置されたヘッドを用いているが、本発明はこれには限定されないものではない。例えば、クリアインク吐出ノズル、インク吐出ノズル、クリアインク吐出ノズル、クリアインク吐出ノズル、インク吐出ノズル、クリアインク吐出ノズル、クリアインク吐出ノズル…の順番でノズルが配置されたヘッド、即ち、インク吐出ノズル間に2つのクリアインク吐出ノズルが配置されたヘッドを用いてもよい。この場合、上記実施形態のヘッドに比べインク吐出ノズル間の距離が長くなるため、同じ1パス記録の記録結果と比べると画像濃度が薄くなってしまふ。その一方で、記録速度を低下せず、表現し得る階調数を増加させることができる。このように本発明では、少なくとも1つのインク吐出ノズルと少なくとも1つの液体吐出ノズルとが交互に隣接して配置されたノズル列を有する記録ヘッドを用いることができるのである。

【0174】本発明に適用可能なインクジェットヘッドとしては上記に示したバブルジェットヘッドに限られるものではなく、ノズルを高集積化できれば圧電素子を備えたピエゾヘッドでもよい。このピエゾインクジェットヘッドは、特公昭63-252750号公報、あるいは特公昭63-247051号公報、特開昭59-48164号公報に示されたように、インク室を形成する容器の壁の一部に圧電素子を設け、信号により圧電素子をたわみ変形させ生じる圧力によってノズルからインク滴を飛ばし、記録紙上にドットを形成するものである。本実施形態においても、従来のインクジェットヘッドの製造方法と同様のプロセスを用いて、基板に圧電素子を形成し、ノズルを形成することができる。

【0175】これらのインクジェットヘッドは図35に示すように、ノズルの並び方向511に互いに間隔を有する複数の平行な流路604を有しており、これら流路604は流路604の相手方向512に伸びる側壁605により区画されている。これら流路604の一端603は複数のノズル502を有するノズル基板501に接続され、他の一端はインクを各流路に補充するインク供給路609に接続されている。側壁605は、その一部あるいは全体が圧電物質で構成され、電気的アクチュエート手段（図示せず）により剪断モードなどのノズルの並び方向511に平行な変形を引き起こし、流路604を圧力発生室としてインクの圧力を変化させ、ノズル502からインク滴を吐出させるものである。

【0176】また、その製造方法は、図36に示すように、厚さ方向に分極された圧電セラミックスからなる上部基板（第1の流路部材）601および下部基板（第2の流路部材）602上に平行な流路604を複数形成す

る。この記録モードまたは第2の記録モードのどちらから一方を設定することで1パス記録を行っている。上記第8の実施形態及び第9の実施形態によれば、短時間で十分高品位な画像を形成できることから1パス記録で十分な場合が多いと考えられる。しかしながら、ユーザーの用途や好みもしくは記録すべき画像によっては、記録時間が長くなったとしてもより高品位な画像を形成する方が好ましい場合もある。このような場合は、マルチパス方式で記録を行うことが好ましい。すなわち、第3の記録モード及び第4の記録モードを設定して記録を行うのである。尚、第3の記録モードが設定されるとその所定領域は記録インクのみで且つ複数回の走査で記録され、第4の記録モードが設定されるとその所定領域は記録インクとクリアインクの双方で且つ複数回の走査で記録される。この第3の記録モード及び第4の記録モードの設定は、ユーザーがインクジェット記録装置に備えられたスイッチやパネルにより設定してもいいし、ホストコンピュータ内で処理するプリンタドライバで設定してもよい。また、第8の実施形態および第9の実施形態と同様に、画像データに応じて、および第9の実施形態と同様に、インクジェット記録装置が自動的に設定してもよい。この場合、第3の記録モードか第4の記録モードのどちらから一方を常に設定するようにしておいてもいいし、第1、第2、第3または第4の記録モードのいずれか一つを画像データに応じて設定するようにしておいてもよい。

【0171】以上のように本実施形態によれば、マルチパス方式で記録を行う第3の記録モードまたは第4の記録モードを用いることで、第1の実施形態～第3の実施形態よりも時間は長くなってしまふが、その代わり第1の実施形態～第3の実施形態よりも高品位な画像の形成が可能となる。

【0172】[他の実施形態]上記第1の実施形態～第10の実施形態では、記録ドットの隣接部にクリアインクを覆染させているが、これはクリアインクに限定されるものではない。本発明を実現するためには、色相を實質的に変化させずに記録ドットの被覆状態を変化させることができるものであればよい。従って、色材を含有しない液体であればよい。特に、記録ドットの色材が染料であればその染料を溶解する液体であればよく、また記録ドットの色材が顔料であればその顔料を分散し均一に保持する液体であればよい。そして、色材を實質的に含有しない液体の中でもクリアインクを用いるが本発明には好適である。なぜなら、クリアインクは、媒体上に覆染させた記録ドットにおける色材との相溶性が均一になりやすいためである。また、クリアインクは、インク吐出から良好に吐出しやすいうに処方されているものであるからである。また、このクリアインクは各色の記録インクに対して共通に用いることが可能であるので、色材を含有する記録インクを複数、例えばCMYの3色ある

【0165】ステップS11において、文字領域のエッジ部データ、文字領域の非エッジ部データ、及び絵柄領域のデータとを結合する。具体的には、文字領域のエッジ部を記録するために得られたデータCと、文字領域の非エッジ部を記録するために得られたデータDと、絵柄領域を記録するために得られたデータEとの理論値をとり、これを記録データとする。

【0166】このようにして得られた記録データは、インターフェース部1603を介してインクジェット記録装置100に伝送され、そしてインクジェット記録装置にて記録が行われる。以上により、文字領域のエッジ部を記録インクのみで記録し、文字領域の非エッジ部及び絵柄領域を記録インクとクリアインクの双方で記録した記録画像が形成される。なお、図64におけるステップS3の文字判定（文字抽出）は、上記第2の実施形態において説明した方法を用いることができる。

【0167】なお、第9の実施形態に係る図28のプロセッサでは、入力された画像データ（文字領域のエッジ部、文字領域の非エッジ部、絵柄領域）に応じて、ホストコンピュータが自動的に第1の記録モードと第2の記録モードとを設定しているがこれに限定されずのもではない。すなわち、第1の記録モードと第2の記録モードの設定をユーザーが行ってもよい。この場合、インクジェット記録装置にスイッチやパネルを設け、それによりモードの設定を行うことが考えられる。もしくは、ホストコンピュータ内で処理するプリンタドライバでユーザーが設定を行ってもよい。このようにユーザーが設定する場合、ユーザーの用途や好みに合わせて画像を出力できるといふ利点がある。一方、ホストコンピュータが自動的に設定する場合は、ユーザーは何もしなくてよいのでユーザーの操作が簡単であるという利点がある。

【0168】なお、上記では文字領域と絵柄領域とが混在した画像を記録する場合を示したが、本実施形態はこれに限定されず、文字のみ、絵柄のみの画像や絵柄のみの画像を記録する場合にも当然適用できる。

【0169】以上のように本実施形態によれば、記録インク吐出用ノズルとクリアインク吐出用ノズルとが交互に配置された高密度ヘッドを用いて画像の記録を行うに際し、階調性が要求される非文字領域（絵柄領域）は記録インクとクリアインクの双方で記録するようにし、階調性が要求されない文字領域のエッジ部は記録インクのみで記録するようにし、文字領域の非エッジ部は記録インクとクリアインクの双方で記録するようにすること

で、階調性に優れた絵柄領域を形成でき、またエッジ強調が施される鮮明な文字を形成できる。従って、本実施形態を用いることで、絵柄領域と文字領域とが混在した画像を記録する場合でも、階調性に優れた絵柄領域と鮮明な文字とを有する高品位な画像が記録可能となる。

【0170】[第10の実施形態]上述した第8の実施形

【0160】図64は第9の実施形態の処理手順を示すフローチャートであり、この処理を実行するためのプログラムは図17のROM1701に格納されている。また、図64に示すフローチャートはMPU1710により実行される。

【0161】まず、ステップS1において、画像入力装置150で原稿が読み取られ、画像が入力される。原稿としては、例えば、文字領域と絵柄領域とが混在した多色画像を有するグラビア雑誌のようなフルカラー画像であり、画像入力装置150で読み取られたフルカラー画像はデジタルデータに変換され、R・G・Bの多値画像データとしてインターフェース部1703を介してホストコンピュータ1710に入力される。次に、ステップS2において、入力されたR・G・Bの多値画像データは、画像処理部1704で、インクジェット記録装置100で出力可能なY・M・C・Bkの2値データに変換される。その後、ステップS3において、2値化されたデータのY・M・C・Bkデータに対して、文字であるか否かの文字判定を行う。つまり、文字領域を抽出するのである。

【0162】文字である文字領域であればステップS4に進み、ステップS4で文字領域のエッジ部を抽出することにより文字領域のエッジ部と非エッジ部とに分離する。その後、ステップS5においてエッジ部を第1の記録モードを記録するように設定し、またステップS7において非エッジ部を第2の記録モードを記録するように設定する。つまり、文字領域のエッジ部と判定された領域は記録インクのみで記録し、文字領域の非エッジ部と判定された領域は記録インクとクリアインクの双方を用いて記録するのである。ステップS5で第1の記録モードを設定したら、ステップS6において前記文字領域のエッジ部を記録するための記録画像データを作成する。ここで得られたデータをデータCとする。その後、ステップS11に進む。

【0163】また、ステップS7で第2の記録モードを設定したら、ステップS8において前記文字領域の非エッジ部を記録するための記録画像データを作成する。ここで得られたデータをデータDとする。その後、ステップS11に進む。尚、ステップS4において文字領域をエッジ部と非エッジ部とに分離する方法は、上記第1の実施形態のエッジ部抽出手段、もしくは第2の実施形態のベタ領域抽出部を用いることによつて行う。

【0164】一方、文字でない絵柄領域であればステップS9に進み、その絵柄領域を第2の記録モードで記録するように設定する。つまり、絵柄領域と判定された領域は、記録インクとクリアインクの双方を用いて記録するのである。ステップS9で第2の記録モードを設定したら、ステップS10において前記絵柄領域を記録するための記録画像データを作成する。ここで得られたデータをデータEとする。その後、ステップS11に進む。

る工程と、図37に示すように、隣接する流路604を区画する側壁605に、電極層607を流路604ごと形成する工程と、図38に示すように、上記工程を施した上部基板601と下部基板602とを、両基板の流路604同士が対向して重なり、上部基板601の側壁電極層607aと下部基板602の側壁電極層607bとが、両基板の表面部608で電気的に接続されるように接続して、流路形成部材606を形成する工程と、ノズル基板501と流路形成部材606の一端とを接合する工程からなるものである。そして、上記バブルジェットヘッドと同様に、流路は図9(a)～(c)示すように構成した。

【0177】ここで、ピエゾインクジェットヘッドの動作の概要について図38～図44を用いて説明する。図38は、ピエゾインクジェットヘッドの全体を表した斜視図である。但し、インクジェット内部を説明するため、一部をカットした状態で示してある。図39は、図38のインクジェットヘッドの手前断面を、ノズル734の位置で切断した、断面図である。

【0178】上記ピエゾインクジェットヘッドの動作概要は、以下のとおりである。その主要部分の構成は、ノズル734が形成されているノズル形成基板733および、インク室751を形成する構造体732および、インク室751と圧力発生部材721との境界を形成する隔壁731および、圧力発生部材721とインク室751を接続するための取り付け接合部730および、インク室751へインクを供給するインク供給口735および、本発明のインクジェットヘッド全体を固定する構造体737とからなっている。

【0179】インクを吐出させる際の動作は、図40及び図41に示したとおりである。ここで、740は駆動用電圧、741は圧力発生部材充電用スイッチ、742は圧力発生部材放電用スイッチ、720は各ノズル734に対応した個別電極、722はすべてのノズルに対応した共通電極である。本発明の実施例では、圧力発生部材として、積層型PZTを用いた。また、利用している変位方向は、積層型PZTの直交方向である。

【0180】図39の状態で、圧力発生部材721に電圧が印加されていない、定常状態を示している。ここで、充電用スイッチ741を閉じ、圧力発生部材721に電圧を印加すると、圧力発生部材721が矢印766の方向へ変位し、同時に接続されている接合部730を引き寄せ、隔壁731がインク室751を拡大させる方向へ変形する。このとき、インク供給口735から、インク室751の体積が増加した分のインクが供給される。次に、図41に示すように、充電用スイッチ741を開き、放電用スイッチ742を閉じる。このとき、圧力発生部材721は、矢印655方向へ変位し、こんどはインク室751の体積を減少させる方向へ作用する。これにより加圧されたインクが、ノズル734より外部

なものを通して、なお、上記駆動作用面の温度上昇率に関する発明の米国特許第4313124号明細書に記載されている条件を採用すると、さらに優れたプリントを行うことができる。

【0192】プリントヘッドの構成としては、上述の各明細書に開示されているような吐出口、液路、電気駆動変換体の組合せ構成（直線状液流路または直角液流路）の他に駆作用部が屈曲する領域に配置されている構成を開示する米国特許第4583333号明細書、米国特許第4459600号明細書を用いた構成も本発明に含まれるものである。加えて、複数の電気駆動変換体に対して、共通するスリットを電気駆動変換体の吐出部とする構成を開示する特開昭59-123670号公報や熱エネルギーを示す特開昭59-138461号公報に基いた構成としても本発明の効果は有効である。すなわち、プリントヘッドの形態がどのようなものであっても、本発明によればプリントを確実に効率よく行うことができるようになるからである。

【0193】さらに、プリント装置がプリントできるプリント媒体の最大幅に対応した長さを有するフルラインタイプのプリントヘッドに対して本発明は有効に適用できる。そのようなプリントヘッドとしては、複数プリントヘッドの組合せによってその長さを満たす構成や、一体的に形成された1個のプリントヘッドとしての構成のいずれでもよい。

【0194】加えて、上例のようなシリアルタイプのものでも、装置本体に固定されたプリントヘッド、あるいは装置本体に装着されることで装置本体との電気的な接続や装置本体からのインクの供給が可能になる交換自在のチップタイプのプリントヘッド、あるいはプリントヘッド自体に一体的にインクタンクが設けられたカートリッジタイプのプリントヘッドを用いた場合にも本発明は有効である。

【0195】また、本発明にプリント装置の構成として設けられる、プリントヘッドに対しての回復手段、予備的な補助手段等を付加することは本発明の効果を一層安定できるもので、好ましいものである。これを具体的に挙げれば、プリントヘッドに対してのキャッピング手段、クリーニング手段、加圧減圧吸引手段、電気駆動変換体はこれとは別の加熱線子或はこれらの組み合わせによる予備加熱手段、プリントとは別の吐出を行う予備吐出モードを行なうことも安定したプリントを行なうために有効である。

【0196】また、搭載されるプリントヘッドの種類ないし個数についても、例えば単色のインクに対応して1個のみが設けられたもの他、プリント色や濃度を異にする複数のインクに対応して複数個が設けられるものでもあってもよい。すなわち、例えばプリント装置のプリントモードとしては黒色等の主顔色のみのプリントモード

【0197】また、搭載されるプリントヘッドの種類ないし個数についても、例えば単色のインクに対応して1個のみが設けられたもの他、プリント色や濃度を異にする複数のインクに対応して複数個が設けられるものでもあってもよい。すなわち、例えばプリント装置のプリントモードとしては黒色等の主顔色のみのプリントモード

本発明を構成することになる。

【0187】プログラムコードを供給するための記憶媒体としては、例えば、フロッピーディスク、ハードディスク、光ディスク、光磁気ディスク、CD-ROM、CD-R、磁気テープ、不揮発性のメモ리카ード、ROMなどを用いることができる。

【0188】また、コンピュータが読出したプログラムコードを実行することにより、前述した実施形態例の機能が実現されるだけでなく、そのプログラムコードの指示に基づき、コンピュータ上で稼動しているOS（オペレーティングシステム）などが実際の処理の一部または全部を行い、その処理によって前述した実施形態の機能が実現される場合も含まれることは言うまでもない。

【0189】さらに、記憶媒体から読出されたプログラムコードが、コンピュータに挿入された機能拡張ボードやコンピュータに接続された機能拡張ユニットに備わるメモリに書き込まれた後、そのプログラムコードの指示に基づき、その機能拡張ボードや機能拡張ユニットに備わるCPUなどが実際の処理の一部または全部を行い、その処理によって前述した実施形態の機能が実現される場合も含まれることは言うまでもない。

【0190】なお、本発明は、種々のインクジェット記録方式が適用可能であるが、特にその中でもインク吐出を行わせるために利用されるエネルギーとして熱エネルギーを発生する手段（例えば電気熱変換体やレーザ光等）を備え、前記熱エネルギーによりインクの状態変化を生じさせる方式のプリントヘッド、プリント装置において優れた効果をもたらすものである。かかる方式によればプリントの高密度化、高精細化が達成できるからである。

【0191】その代表的な構成や原理については、例えば、米国特許第4723129号明細書、同第4740796号明細書に開示されている基本的な原理を用いて行うのが好ましい。この方式は所謂オンデマンド型、コンティニューアス型のいずれにも適用可能であるが、特に、オンデマンド型の場合には、液体（インク）が保持されているシーストや液路に対応して配置されている電気熱変換体は、プリント情報に対応して加熱動作を越える急速な温度上昇を与える少なくとも1つの駆動信号を印加することによって、電気熱変換体に熱エネルギーを生じさせ、結果的にこの駆動信号に一对一で対応した液体（インク）内の気泡を形成できるのが有効である。この気泡の成長、収縮により吐出用開口を介して液体（インク）を吐出させて、少なくとも1つの滴を形成する。この駆動信号をバルス形状とすると、即時適切に気泡の成長収縮が行われる形で、特に応答性に優れた液体（インク）の吐出が達成でき、より好ましい。このバルス形状の駆動信号としては、米国特許第4463359号明細書、同第4345262号明細書に記載されているよう

だけでなく、プリントヘッドを一体的に構成するか複数の色組み合わせによる色合い、異なる色の色調、または色によるフルカラーの少ないもの一つを備えた装置にも本発明は極めて有効である。

【0197】さらに加えて、以上説明した本発明実施例においては、インクを液体として説明しているが、室温やそれ以下で固化するインクであって、室温で軟化もしくは溶化するもの、あるいはインクジェット方式ではインク自体が30℃以上70℃以下の範囲内で温度調整を行ってインクの粘性を安定吐出範囲にあるように温度制御するものが一般的であるから、使用プリント信号付与時にインクが溶け出すものであればよい。加えて、積極的に熱エネルギーによる昇温をインクの固形状態から液体状態への状態変化のエネルギーとして使用せしめることで防止するか、またはインクの蒸発防止を目的として放熱状態で固化するインクを用いるかして、いずれにしても熱エネルギーのプリント信号に付した付与によってインクが液体化し、溶けインクが吐出されるものや、プリント媒体に到達する時点ですべてに固化し始めるもの等のような、熱エネルギーによって初めて溶け化する性質のインクを使用する場合も本発明は適用可能である。このように、熱エネルギーは、特開54-56847号公報あるいは特開昭60-71260号公報に記載されるような、多れ質シント樹脂または貫通孔に液状又は固形状物として保持された状態で、電気熱変換体に対して対向するような形態としてもよい。本発明においては、上述した各インクに対して最も有効なものは、上述した膜潤滑方式を実行するものである。

【0198】さらに加えて、本発明の液体噴射プリントヘッドを使用してプリント機構を備えたプリント装置の形態としては、コンピュータ等の情報処理機器の画像出力端末として用いられるもの、他、リーダー等と組合せた複写装置、さらには送受信機能を有するファクシミリ装置の形態を採るもの等であつてもよい。

【0199】
【発明の効果】以上のように本発明によれば、インク吐出ノズルと液体吐出ノズルとが交互に配列した高密度記録ヘッドを用いることで、高画質と高速化の双方を両立させることが可能となる。

【0200】また、記録インクとクリアインクの双方を用いて画像を形成することで、出力解像度を低下させずに中間調の階調数を増加させることができる。それにより、スムーズなグラデーションが実現可能となり、またハイレイト部の軟化感も低減する。

【0201】また、インク吐出ノズルと液体吐出ノズルとが配列したノズル列を有するライン型ヘッドを用いることで、装置の大型化やコストアップを伴わず、高画質化及び高速化を実現することができる。

【図面の簡単な説明】

【図1】本発明に適用可能なインクジェット記録装置に

格載する記録ヘッドの概略構成図であり、ノズルが直線的に配列された記録ヘッド（直線配列型記録ヘッド）を示している。

【図2】図1に示した記録ヘッド90を複数個具備した記録ヘッドユニット9の構成を示す図であり、(a)は図1で示した直線配列型記録ヘッド90を横一列に配列した場合を示しており、(b)は図1で示した直線配列型記録ヘッド90を縦一列に配列した場合を示している。

【図3】本発明に適用可能なシリアル型のインクジェット記録装置の一例を示す斜視図である。

【図4】本発明に適用可能なライン型のインクジェット記録装置の一例を示す斜視図である。

【図5】シリアル型のインクジェット記録装置の記録動作を示す図である。

【図6】バブルジェットヘッドの吐出エレメントの構成を示す図である。

【図7】バブルジェットヘッドの構成を示す概略図である。

【図8】バブルジェットヘッドの構成を示す概略図である。

【図9】記録インクとクリアインクをノズル列に交互に供給するための配流路の一例を示す図であり、(a)は透明斜視図、(b)は透明正面図(c)は側面断面図である。

【図10】記録インク及びクリアインクの双方を用いる記録モードに基づき記録を行う場合を示す図であり、(a)は記録インク吐出ノズルとそれに隣接する少なくとも1つのクリアインク吐出ノズルとを共に駆動することを示しており、(b)は被記録媒体上に着弾した記録インクドットとクリアインクドットが混和している様子を示している。

【図11】1200 dpiのヘッドを示す図であり、全てのノズルに記録インクが供給されていることを示している。

【図12】1200 dpiのヘッドを示す図であり、1つおきのノズルに記録インクが供給されていることを示している。

【図13】インク吐出ノズルとクリアインク吐出ノズルとが交互に配置された記録ヘッドを示す図であり、インク吐出ノズルのみを駆動していることを示している。

【図14】記録インク及びクリアインクの双方を用いる記録モードに基づき記録を行う場合を示す図であり、(a)は記録インク吐出ノズルとそれに隣接する2つのクリアインク吐出ノズルとを共に駆動することを示しており、(b)は被記録媒体上に着弾した記録インクドットとクリアインクドットが混和してその双方のドットが混和する様子を示している。

【図15】ベタ濃度がDsの第1インクとベタ濃度がDs/2の第2インクの2種類のインクによるドット被覆

率と光学反射濃度(OD値)との関係を示している図である。

【図16】図3に示すインクジェット記録装置のブロック図である。

【図17】ホストコンピュータ1710の制御系の構成を示すブロック図である。

【図18】ベタ被覆出力1705の構成を示すブロック図である。

【図19】第1の実施形態例に係る処理手順を示すフローチャートである。

【図20】1つの画素集合の輪郭線を追跡した例を示す図である。

【図21】輪郭線方向を示す図である。

【図22】第2の実施形態例に係る処理手順を示すフローチャートである。

【図23】図22における文字判定の処理手順を示すフローチャートである。

【図24】X方向の射影1次元データを概念的に示す図である。

【図25】射影データから捉えられる特徴量を概念的に示す図である。

【図26】文字判定を行う他の方法を説明するための図である。

【図27】文字判定を行う他の方法を説明するための図である。

【図28】クリアインクと記録ドットを接触させることで記録ドットの被覆状態が変化する様子を示した図である。

【図29】ドットマトリクス内に記録ドットとクリアインクドットとを配置したドットパターンである。

【図30】階調を表現するドットパターンの一例を示す図である。

【図31】階調を表現するドットパターンの一例を示す図である。

【図32】階調を表現するドットパターンの一例を示す図である。

【図33】階調を表現するドットパターンの一例を示す図である。

【図34】第4の実施形態を示すフローチャートである。

【図35】従来のピエゾインクジェットヘッド及びその製造方法を示す製造工程図である。

【図36】ピエゾインクジェットヘッドの製造工程図である。

【図37】ピエゾインクジェットヘッドの製造工程図である。

【図38】本発明に適用可能なインクジェットヘッドの斜視図である。

【図39】本発明に適用可能なインクジェットヘッドの縦断面図である。

【図40】本発明に適用可能なインクジェットヘッドの縦断面図で、圧力発生部材が縮んでいる状態の図である。

【図41】本発明に適用可能なインクジェットヘッドの縦断面図で、圧力発生部材が伸びている状態の図である。

【図42】圧力発生部材が縮むときの動作説明図である。

【図43】圧力発生部材が伸びるときの動作説明図である。

【図44】圧力発生部の斜視図である。

【図45】本発明に適用可能なインクジェット記録装置に格載する記録ヘッドの概略構成図であり、ノズルが千鳥状に配列された記録ヘッド（千鳥配列型記録ヘッド）を示している。

【図46】記録インク1ドットとクリアインク1ドットを被記録媒体に着弾させた図であり、(a)は記録インクとクリアインクを隣接する位置に着弾させた場合であり、(b)は記録インクとクリアインクを同じ位置に着弾させた場合である。

【図47】記録インクとクリアインクの双方でベタ印字を行うことを示した図である。

【図48】第5の実施形態で適用可能な記録ヘッドの概略構成図であり、(a)は相対的に径が小さい記録インク吐出ノズルと相対的に径が大きいクリアインク吐出ノズルが直線的に配列された記録ヘッド（直線配列型記録ヘッド）であり、(b)はこれらのノズルが千鳥状に配列された記録ヘッド（千鳥配列型記録ヘッド）である。

【図49】図48に示した記録ヘッド90を複数個具備した記録ヘッドユニット9の構成を示す図であり、(a)は図48で示した直線配列型記録ヘッド90を横一列に配列した場合を示しており、(b)は図48で示した直線配列型記録ヘッド90を縦一列に配列した場合を示している。

【図50】第5の実施形態で適用可能なヘッドを用い、記録インクのみを用いる記録モードに基づき記録する場合と、記録インク及びクリアインクの双方を用いる記録モードに基づき記録する場合とを示す図である。

【図51】第6の実施形態で適用可能な記録ヘッドの概略構成図であり、(a)は相対的に径が小さいクリアインク吐出ノズルと相対的に径が大きい記録インク吐出ノズルが直線的に配列された記録ヘッド（直線配列型記録ヘッド）であり、(b)はこれらのノズルが千鳥状に配列された記録ヘッド（千鳥配列型記録ヘッド）である。

【図52】図51に示した記録ヘッド90を複数個具備した記録ヘッドユニット9の構成を示す図であり、(a)は図51で示した直線配列型記録ヘッド90を横一列に配列した場合を示しており、(b)は図51で示

した並列型記録ヘッド90を縦一列に配列した場合を示している。

【図53】第6の実施形態で通用可能なヘッドを用い、記録インクのみを用いる記録モードに基づき記録する場合と、記録インク及びクリアインクの双方を用いる記録モードに基づき記録する場合とを示す図である。

【図54】従来の記録方法を用いて2回の走査により画像を記録した場合を示している。

【図55】走査と走査の間つなぎ部分においてクリアインクを出さず記録する場合を示した図である。

【図56】各走査によるつなぎ部分以外の領域に対して記録ヘッドを1回だけ相対走査させることにより画像の記録を行う1パス記録法に關して説明するための図である。

【図57】各走査によるつなぎ部分以外の領域に対して記録ヘッドを2回相対走査させることにより画像の記録を行う2パス記録法に關して説明するための図である。

【図58】第8の実施形態に係るインクジェット記録装置の各部の制御を実行するための制御回路を示すブロック図である。

【図59】図58の各部の詳細を示す回路図である。

【図60】印字データの流れを説明する図である。

【図61】エッジ部を記録インクのみで記録し、非エッジ部を記録インクとクリアインクの双方で記録した場合を示す図である。

【図62】エッジ部も非エッジ部も記録インクとクリアインクの双方で記録した場合を示す図である。

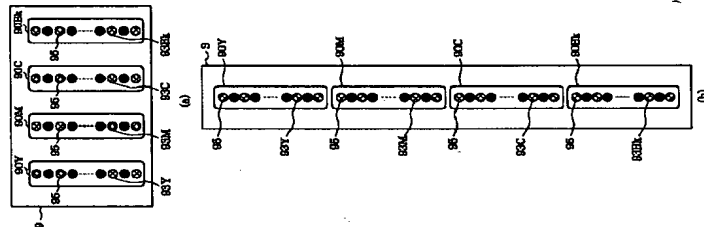
【図63】第8の実施形態によるインクジェット記録装置の画像データ処理のブロック図である。

【図64】第9の実施形態例に係る処理手順を示すフローチャートである。

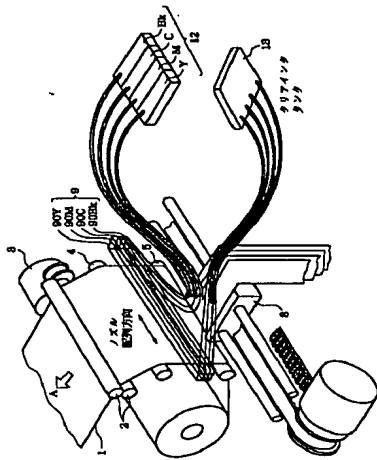
【符号の説明】

- 1 板記録媒体
- 2 給紙ローラ
- 3 副走査モータ
- 4 搬送ローラ
- 5 搬送ローラ
- 6 ガイドレール
- 7 ガイドレール
- 9 記録ヘッドユニット
- 10 12 記録インクタンク
- 13 クリアインクタンク
- 90 記録ヘッド
- 93 記録インク吐出用ノズル
- 95 クリアインク吐出用ノズル
- 100 インクジェット記録装置
- 150 画像入力装置
- 1700 MPU
- 1701 ROM
- 1702 RAM
- 20 1703 インターフェース部
- 1704 画像処理部
- 1705 ベタ領域検出部
- 1707 操作部
- 1710 ホストコンピュータ
- 7000 プリントバッファ
- 7001 非エッジ部データプリントバッファ
- 7002 非エッジ部データ処理部
- 7004 エッジ部検出手段
- 7005 エッジ部データプリントバッファ
- 7006 エッジ部データ処理部

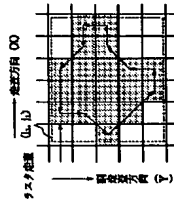
【図2】



【図4】



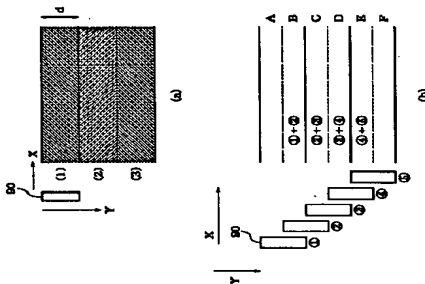
【図20】



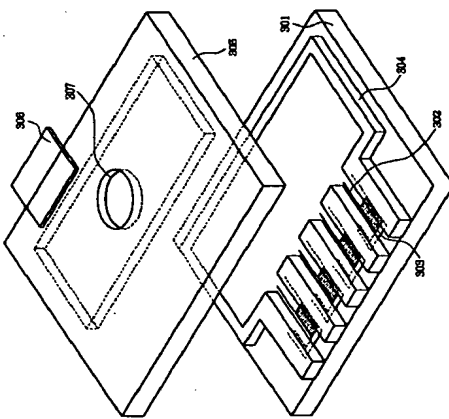
【図21】



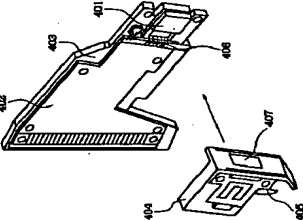
【図5】



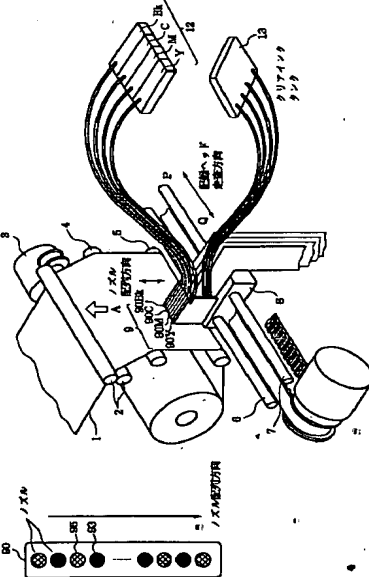
【図6】

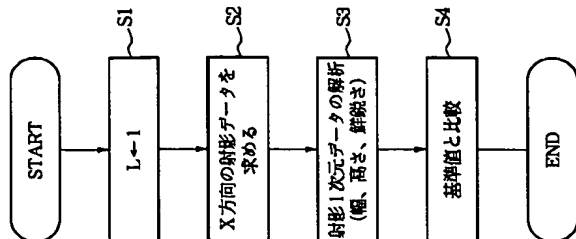
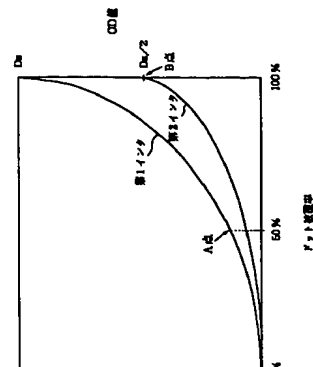
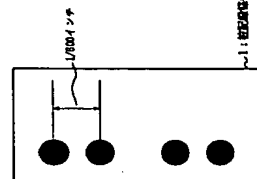
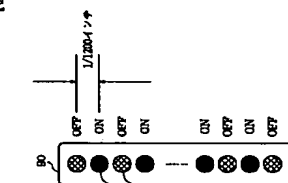
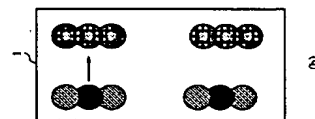
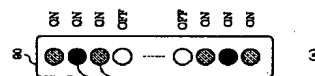
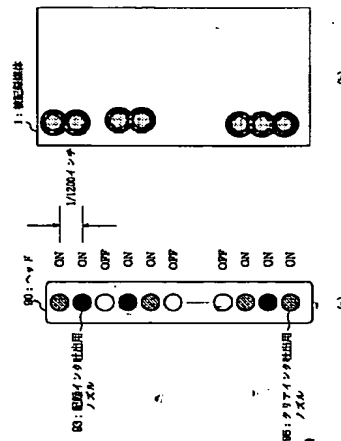
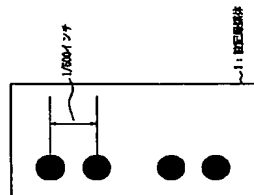
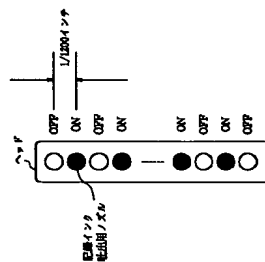
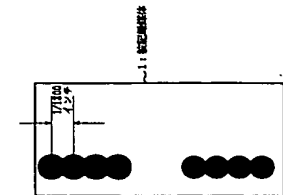
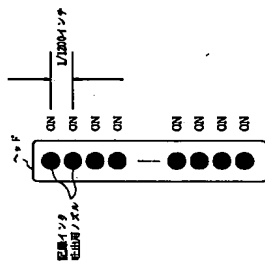
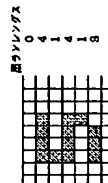
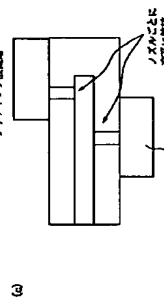
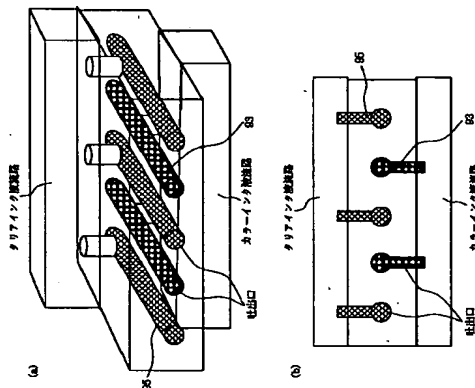
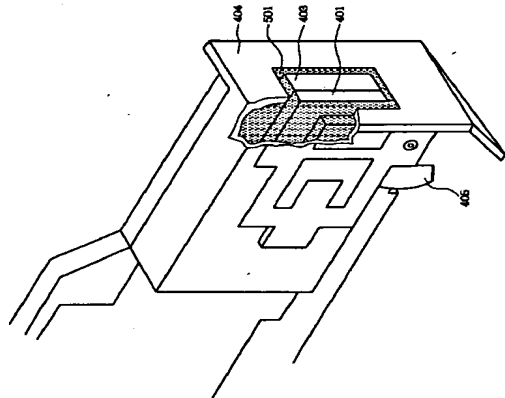


【図7】

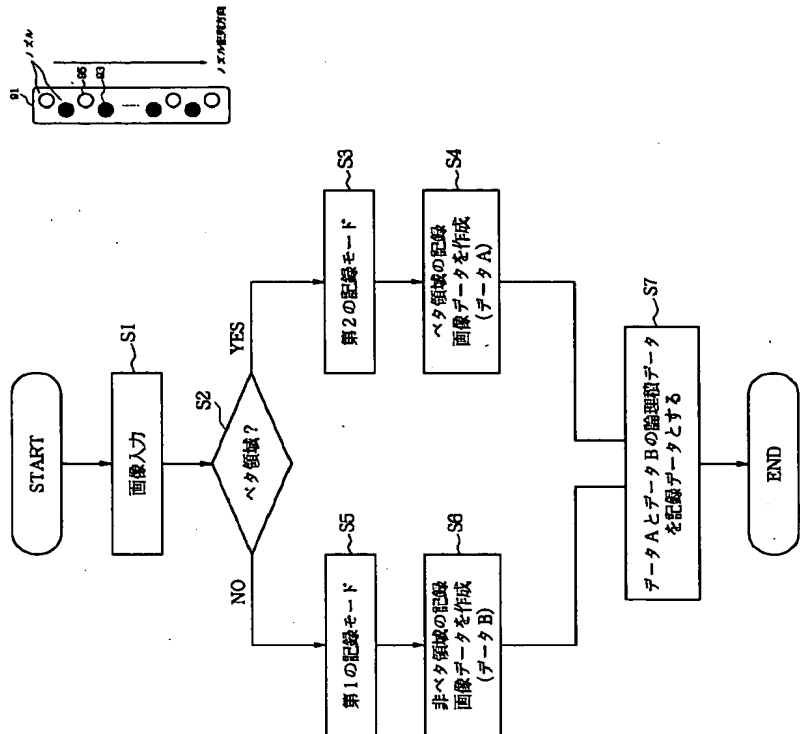


【図3】



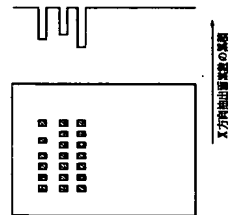


【図 19】

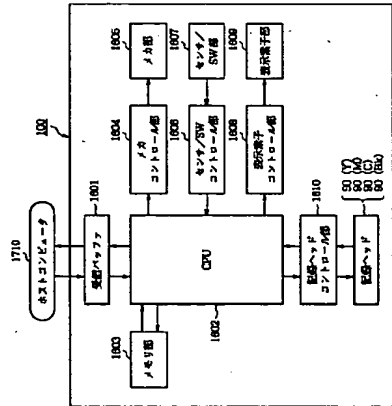


【図 19】

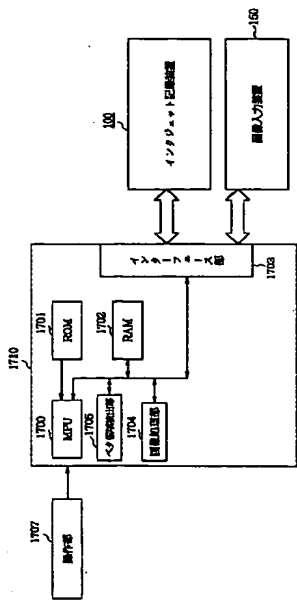
【図 24】



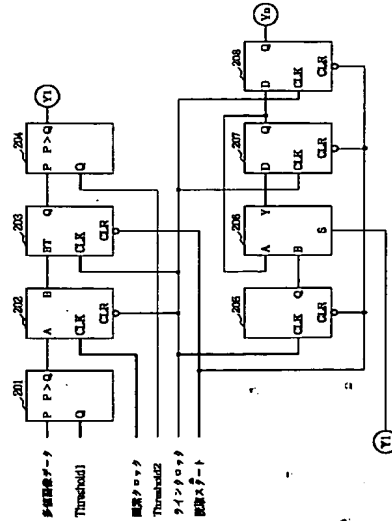
【図 16】



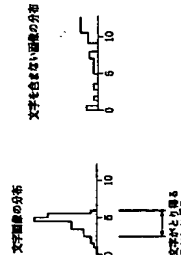
【図 17】



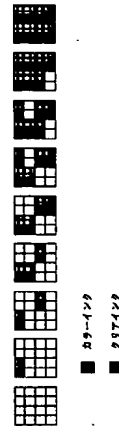
【図 18】



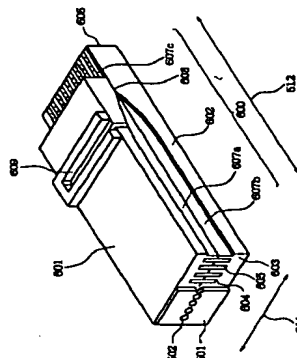
【図 27】



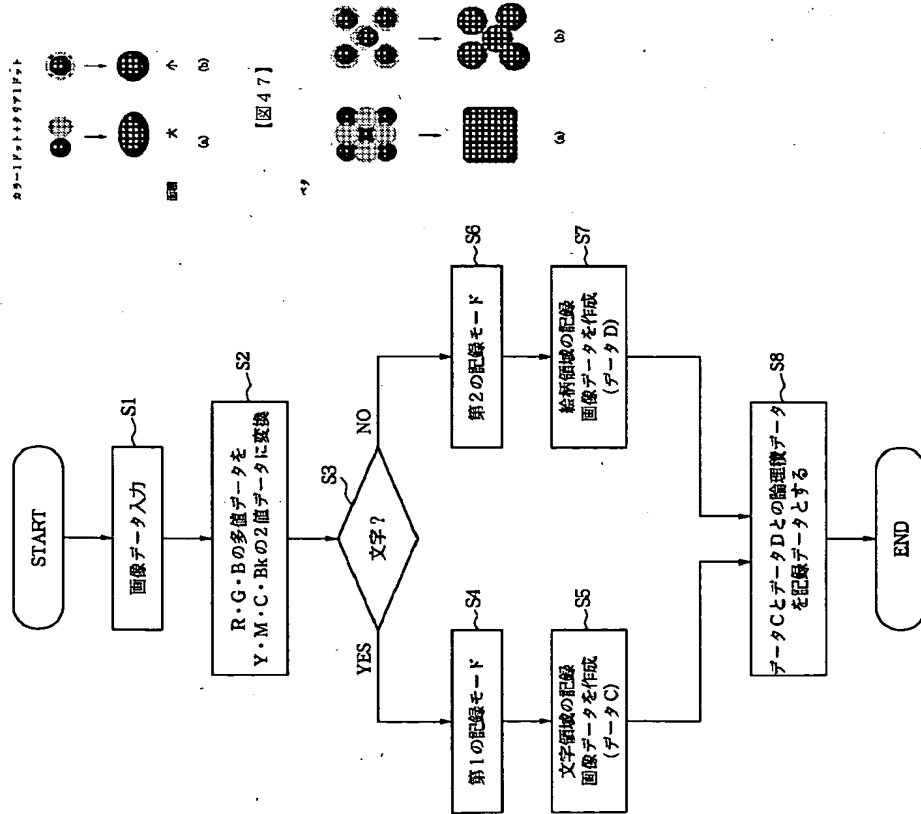
【図 32】



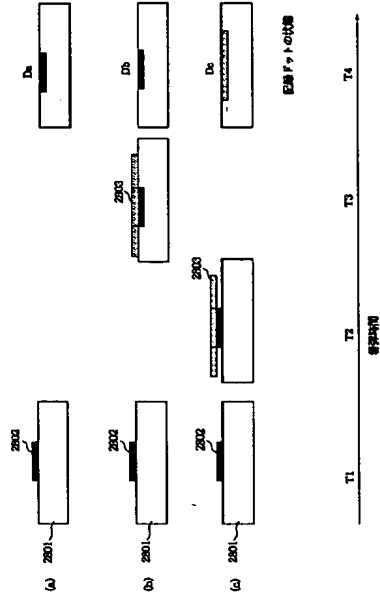
【図 35】



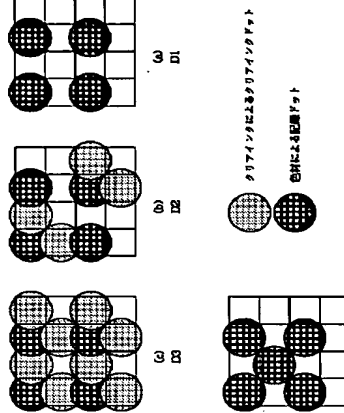
【図22】



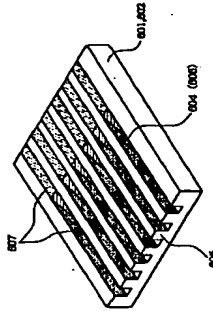
【図28】



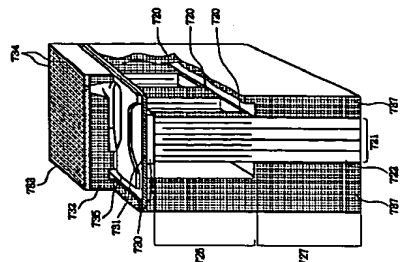
【図29】



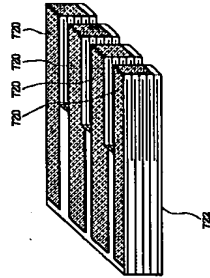
【図37】



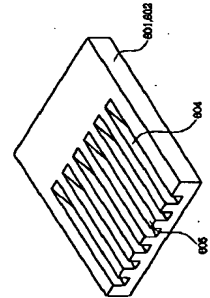
【図38】



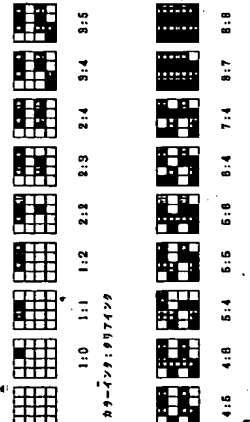
【図44】



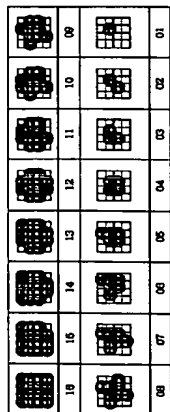
【図36】



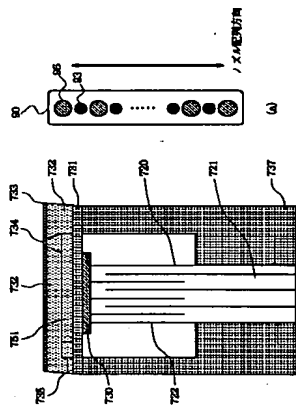
【図33】



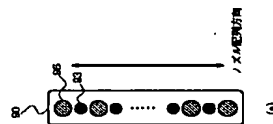
【图30】



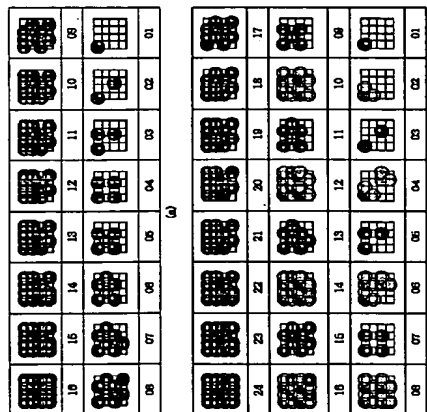
【☒39】



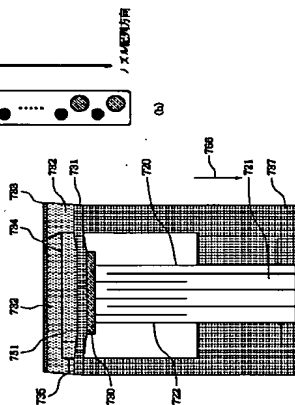
【☒48】



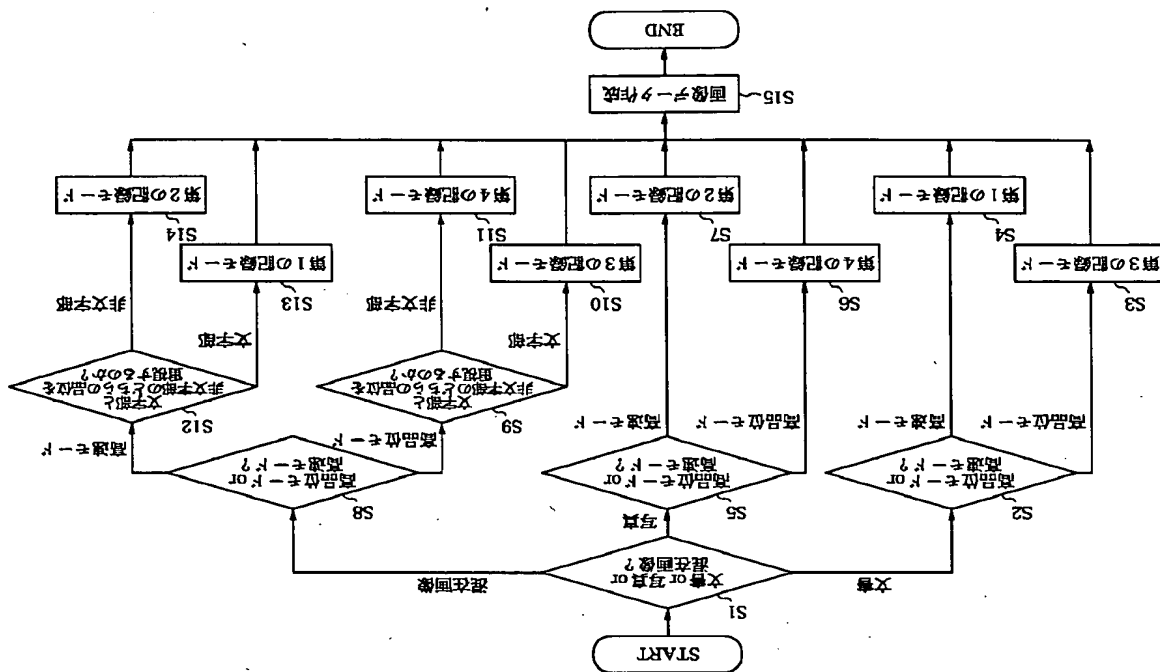
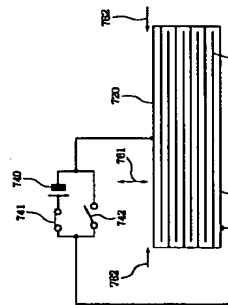
【图31】



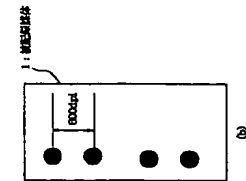
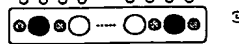
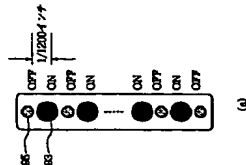
【☒40】



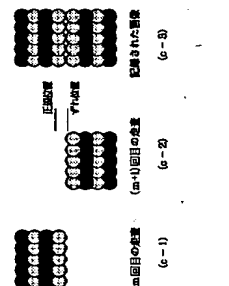
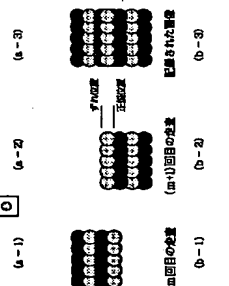
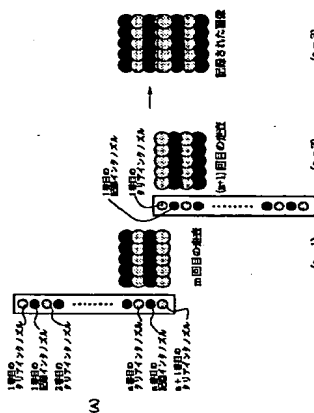
【例42】



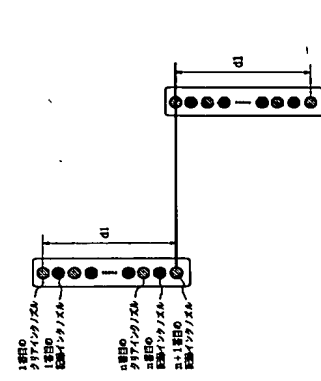
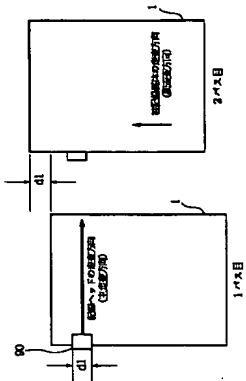
【図53】



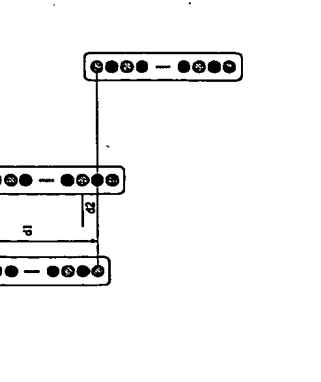
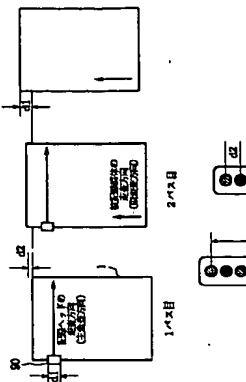
【図55】



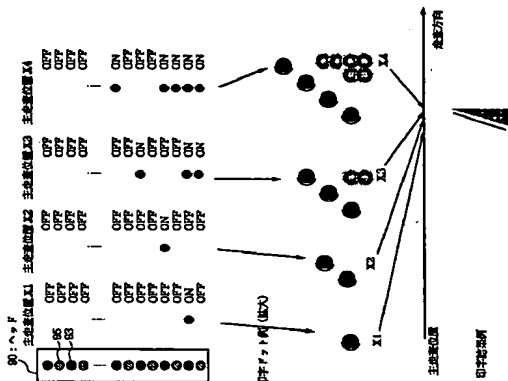
【図56】



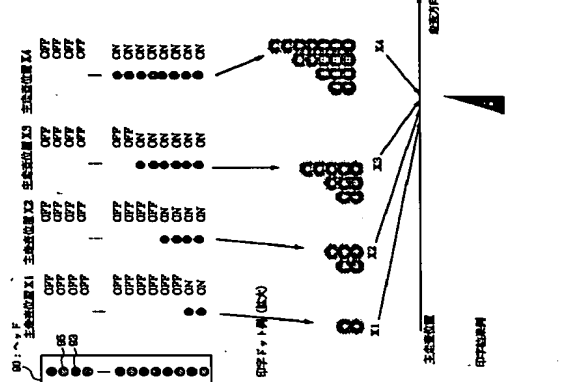
【図57】



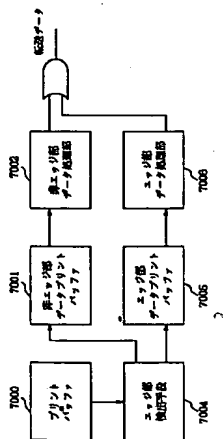
【図61】



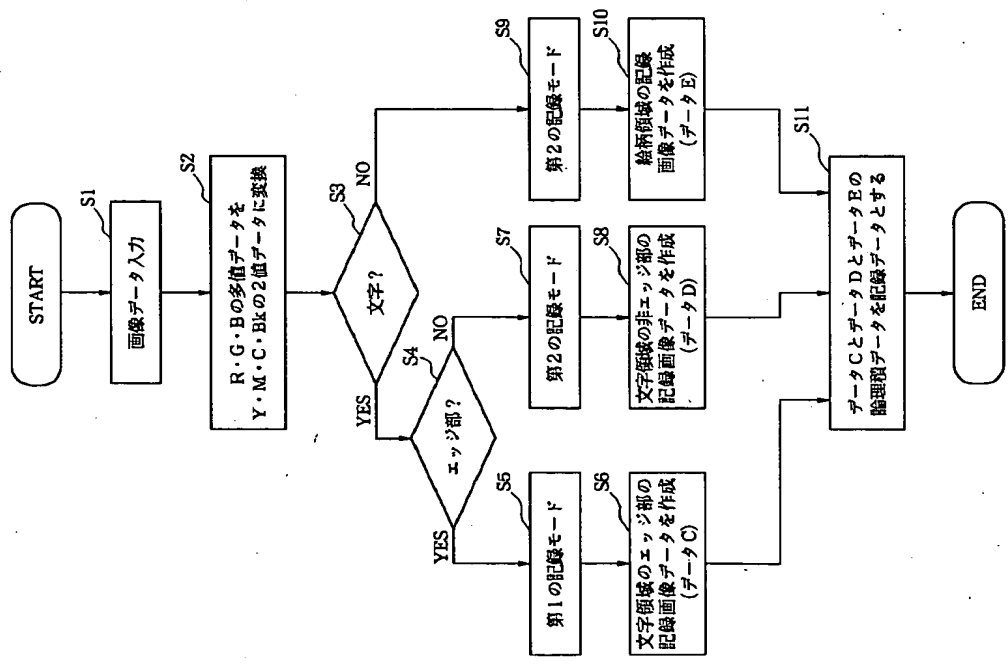
【図62】



【図63】



【図64】



フロントページの続き

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